RECONNAISSANCE OF METAL MINING IN THE SAN JUAN REGION, OURAY, SAN JUAN, AND SAN MIGUEL COUNTIES, COLO.

BY WILLIAM H. KING AND PAUL T. ALLSMAN

* * * * * * * * * * Information Circular 7554

UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary
BUREAU OF MINES
James Boyd, Director

The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is made: "Reprinted from Bureau of Mines Information Circular 7554."

March 1950

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

RECONNAISSANCE OF METAL MINING IN THE SAN JUAN REGION, OURAY, SAN JUAN, AND SAN MIGUEL COUNTIES, COLO.

by

William H. King[1/] and Paul T. Allsman[2/]

CONTENTS

	Page
Summary	5
Introduction	5
Acknowledgments	6
Physical features and communications	6
History and production	7
General geology	10
Mining operations	13
Sneffels-Telluride area	13
General description of the deposits	13
Telluride Mines, Inc.	14
Description of the deposits	15
Development and mining	16
Idarado Mining Co.	19
Description of the deposit	20
Development and mining	20
Haulage	23
Camp Bird mine	25
Description of the deposit	25
Development and mining	26
Revenue tunnel group of mines	27
Description of the deposit	27
Development and mining	28
Non-operating mines	29
Iron Springs mining district	32
General description of the deposits	32
Silver Bell Mines Co.	33
Description of the deposit	33
Development and mining	33
San Bernardo mine	34
Description of the deposit and mine	35
Silver Pick mine	36
Description of the deposit	36
Development and mining	36
Red Mountain district	37
General description of the deposits	37
American Zinc, Lead & Smelting Co.	37
Description of the deposit	38
Development and mining	39

1/ Mining Engineer, Bureau of Mines.
2/ Chief, Salt Lake City Branch, Mining Division, Bureau of Mines.

Information Circular 7554

Generated on 2024-09-19 22:07 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

CONTENTS (Cont'd.)

	Page
Mining operations (Cont'd.)	
Red Mountain district (Cont'd.)	
Lark mine	40
Description of the deposit	40
Development and mining	41
Beaver and Belfast	41
Description of the deposits	42
Development and mining	42
Genessee-Vanderbilt	42
Description of the deposit	43
Development and mining	44
Lost Day mine	45
Ida L	46
Description of the deposit	46
Development and mining	46
Silver Crown	47
Ouray district (Uncompahgre)	47
General description of the deposits	48
Bachelor mine	48
Description of the deposit	48
Development and mining	49
Portland mine	50
Non-operating mines	50
Upper Uncompahgre, Poughkeepsie Gulch, and Mineral Point	52
General description of the deposits	53
Michael Breen mine	54
Description of the deposit	54
Development and mining	55
Mountain Queen mine	57
Description of the deposit	57
Development and mining	57
Burrows mine	58
Little Ida mine	59
Columbus mine	61
Silver Coin mine	62
Silverton area	63
General description of the deposits	63
The Shenandoah-Dives Mining Co.	64
Description of the deposit	65
Development and mining	67
Mine haulage	69
Auxiliary installations	69
Sunnyside mine	70
History	70
Geology	70
Former operations	71

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

CONTENTS (Cont'd.)

	Page
Mining operations (Cont'd.)	
Silverton area (Cont'd.)	
Pride of the West mine	71
Description of the deposit	72
Development and mining	72
Green Mountain mine	73
Description of the deposit	73
Development and mining	74
Treasure Mountain Gold Mining Co.	75
Description of the deposit	75
Development and mining	76
Lead Carbonate mine	77
Description of the deposit	78
Development and mining	79
Highland Mary mine	80
Description of the deposit	80
Development and mining	80
Haulage	81
Power	81
Garry Owen	82
Description of the deposit	82
Development and mining	83
Oscecla mine	84
Description of the deposit	84
Development and mining	85
Great Eastern mine	86
Description of the deposit	86
Development and mining	87
Mayday Mining Co.	87
Description of the deposit	88
Development and mining	88
Philadelphia and Little Fanny	88
Description of the deposit	89
Development and mining	89
Bandora (Esmeralda)	90
Description of the deposit	90
Development and mining	90
Milling operations	91
Telluride Mines, Inc. mill	91
Milling	91
Idarado Mining Co. mill	94
Milling	94
King Lease mill	96
Milling	97
American No. 1 custom mill	98
Milling	99
Pride of the West mill	101
Milling	102

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

CONTENTS (Cont'd.)

	Page
Milling operations (Cont'd.)	
Highland Mary mill	103
Milling	104
Lead Carbonate mill	104
Milling	105
Shenandoah-Dives mill	106
Milling	106
Silver Bell mill	108
Milling	108
Idle mills	109
Alta Mines, Inc. mill	109
Paragon mill of San Bernardo mine	109

ILLUSTRATIONS

Fig.		Follows page
1.	Location map showing San Juan Region, Colorado	6
2.	General geologic map showing location of mines in San Juan Region, Colorado	6
3.	Road and railroad map showing location of San Juan Region, Colorado	12
4a.	Location map of mines, San Juan Region, Colorado	12
4b.	Location map of mines, San Juan Region, Colorado	
5a.	Longitudinal section of shrinkage stope, Telluride Mines, Inc.	16
5b.	Cross section through grizzly chamber, Telluride Mines, Inc.	16
6.	Longitudinal section, Idarado Black Bear mine	20
7a, b, c.	Plan of underground workings, Camp Bird mine, Ouray County, Colo.	26
8a, b, c.	Vertical projection, underground workings, Camp Bird mine	26
9.	Plan and sections of workings on Ida Vein, 6th level to 14th level, and Butterfly 3rd level, Silver Bell mine	34
10.	Plan and section of underground workings of San Antonio mine	38
11.	Claim map and workings of Lark mine	40
12.	Longitudinal section through Shenandoah-Dives mine workings	64
13a, b.	Composite plan of level workings, Pride of the West mine, San Juan County, Colo.	72
14.	Plan and longitudinal section of Green Mountain mine	80
15.	Longitudinal section of Highland Mary mine	80
16.	Flow sheet of Telluride Mines, Inc., mill	90
17.	Flow sheet of the Idarado mill	94
18.	Flow sheet of the King Lease mill, Camp Bird mine.	96
19.	Flow sheet, American No. 1 mill	98
20.	Flow sheet, Pride of the West mill	100
21.	Flow sheet of the Lead Carbonate mill	104
22.	Shenandoah-Dives mill, Silverton, Colo.	106
23.	Flow sheet of the Silver Bell mill	108

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

SUMMARY

This paper describes the mineral deposits and discusses mining and milling methods and related operating conditions in an important gold, silver, lead, and zinc producing area in Ouray, San Juan, and San Miguel Counties, Colo., embracing 250 square miles. The area is extremely rugged, ranging in altitude from 8,000 to 14,000 feet.

White men first penetrated the area in 1860, when a group known as "Baker's party" reached the Animas River at the present site of Silverton. Difficulty with the Ute Indians and severe winter conditions forced the group to leave and discouraged prospecting until 1870 when a second party reached the area and succeeded in producing 27 tons of ore yielding $150 a ton in gold. In 1874, a treaty with the Indians opened the way for settlement, and mining was established. The total production of recovered gold, silver, copper, lead, and zinc from 1873 to 1947 in the three counties is valued at $347,057,047.

The greatest amount of the total production of metals has come from quartz veins in a series of volcanic flows and tuffs covering the area and comprising a blanket 4,000 to 6,000 feet thick. The igneous rocks were laid down upon an old erosion surface and are underlain by Paleozoic and Mesozoic sedimentary rocks and pre-Cambrian metamorphic rocks. The entire series has been intruded in late Tertiary time by volcanic dikes and larger intrusive masses.

Because of the great differences in relief generally, mining is conducted through long adits to a depth of nearly 3,000 feet below surface in places. Walls of the veins generally stand well, and shrinkage stoping is the most common method of mining.

As virtually all of the ore is sulfide below the zone of oxidation, flotation is the common method of milling. Generally, where gold is important, provision is made for its removal by jigs. Bulk concentration of the sulfides is practiced at smaller mills, but the larger operations make a selective lead and zinc concentrate or a lead, zinc, and copper concentrate.

INTRODUCTION

This paper is one of a series on the mineral resources of the nation. It briefly describes the mineral deposits and discusses mining and milling methods and related operating conditions in an important gold, silver, lead, and zinc producing area in Ouray, San Juan, and San Miguel Counties, Colo. The area, comprising several districts, is part of what generally is known

Generated on 2024-09-19 21:55 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

as the San Juan region and embraces about 250 square miles extending in general from Ouray on the north to Silverton on the south and from the San Juan-Hinsdale County line on the east to Ophir on the west.

Published reports have been drawn on freely, and this information is credited in the report; however, most of the operating data have been obtained direct from the operators through field contacts. It is planned to supplement this general report by individual detailed reports on operating mines later.

ACKNOWLEDGMENTS

The writers acknowledge the willing cooperation of the many operators in the area and particularly the opportunity to visit the properties and witness operations. Wm. M. Traver, Jr.,3/ assisted the writers in making contacts in the field and collecting data. A. T. Sweet4/ was of great help in collecting and reviewing information on milling operations. Production statistics were supplied by A. J. Martin.5/

PHYSICAL FEATURES AND COMMUNICATIONS

The area under discussion (figs. 1 and 2) covers about 250 square miles between Ouray on the north, Silverton on the south, the Hinsdale-San Juan County line on the east, and Ophir on the west. This is about 2.5 percent of the area generally referred to as the San Juan region; however, it is the principal source of most of the mineral production.

The entire area is extremely rugged, ranging in altitude from 8,000 to 14,000 feet, and comprises many dissecting, deep, steep-walled canyons and basins, sharp peaks, and jagged ridges. Many slopes are covered with coarse talus slides, and glaciation has left numerous morainal deposits and cirques in the canyons. Numerous small lakes are found at higher altitudes. The Continental Divide passes through the southeast portion of the area. The northeast portion drains into the Uncompahgre River, the northwest portion into the San Miguel River, and the southern portion into the Animas River.

Below timberline, which ranges between 11,000 and 11,500 feet in altitude, slopes, particularly on the southern exposures, are covered with fir, spruce, and aspen. Above timberline the surface generally is bare.

The climate may be considered rigorous. Heavy snow generally begins to accumulate in October and remains until summer. Large patches on northern slopes often remain throughout the summer. Mining is often severely hampered by these extreme conditions, and prospecting is virtually impossible during 6 to 7 months of the year. A rainy season occurs during July and August. Because of the abundant precipitation, water for mining and milling is plentiful.

3/ Supervising engineer, Bureau of Mines, Denver, Colo.
4/ Metallurgist, Bureau of Mines, Denver, Colo.
5/ Supervising engineer, Economics and Statistics Division, Denver, Colo.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

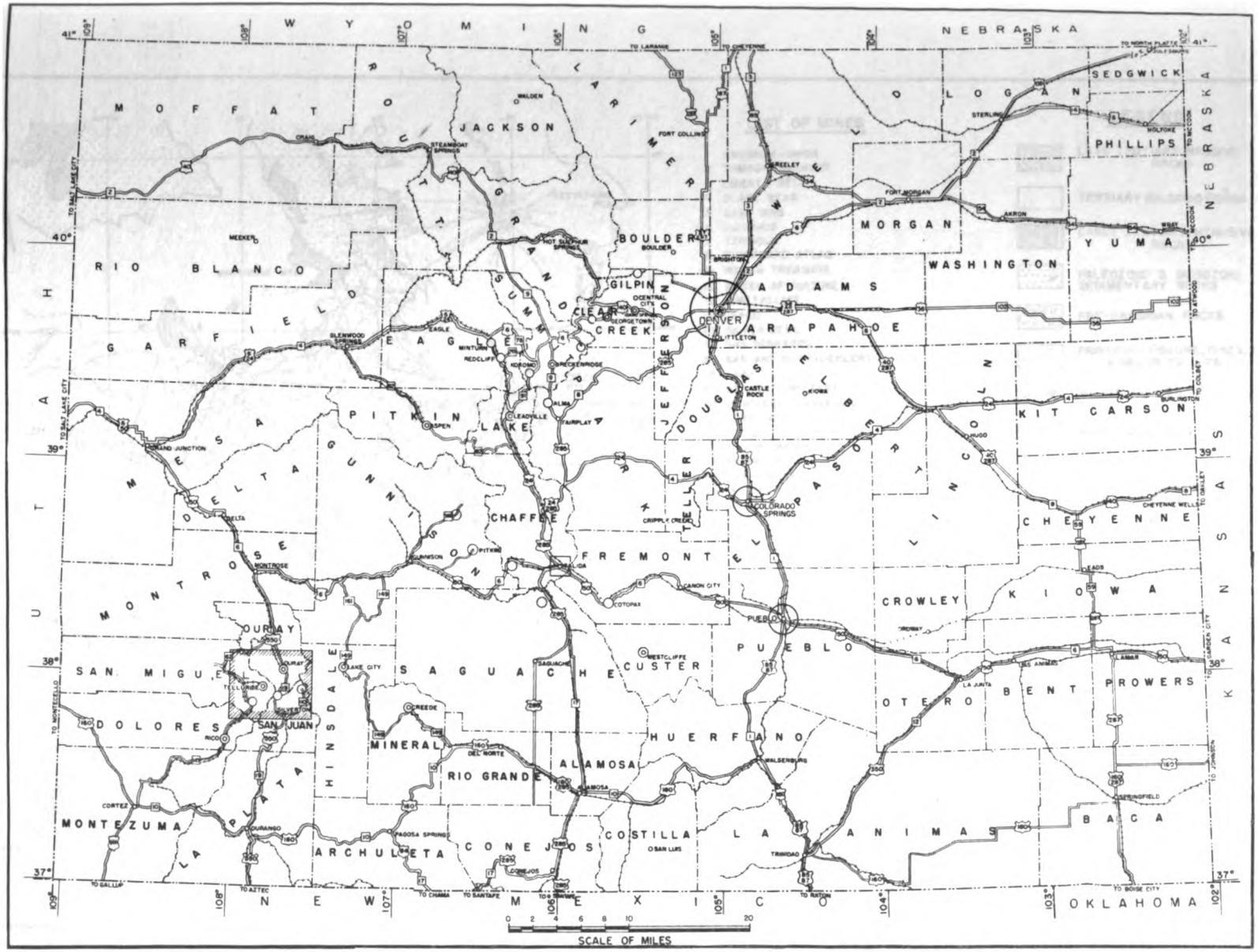

Figure 1. - Location map showing San Juan Region, Colorado.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 22:02 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

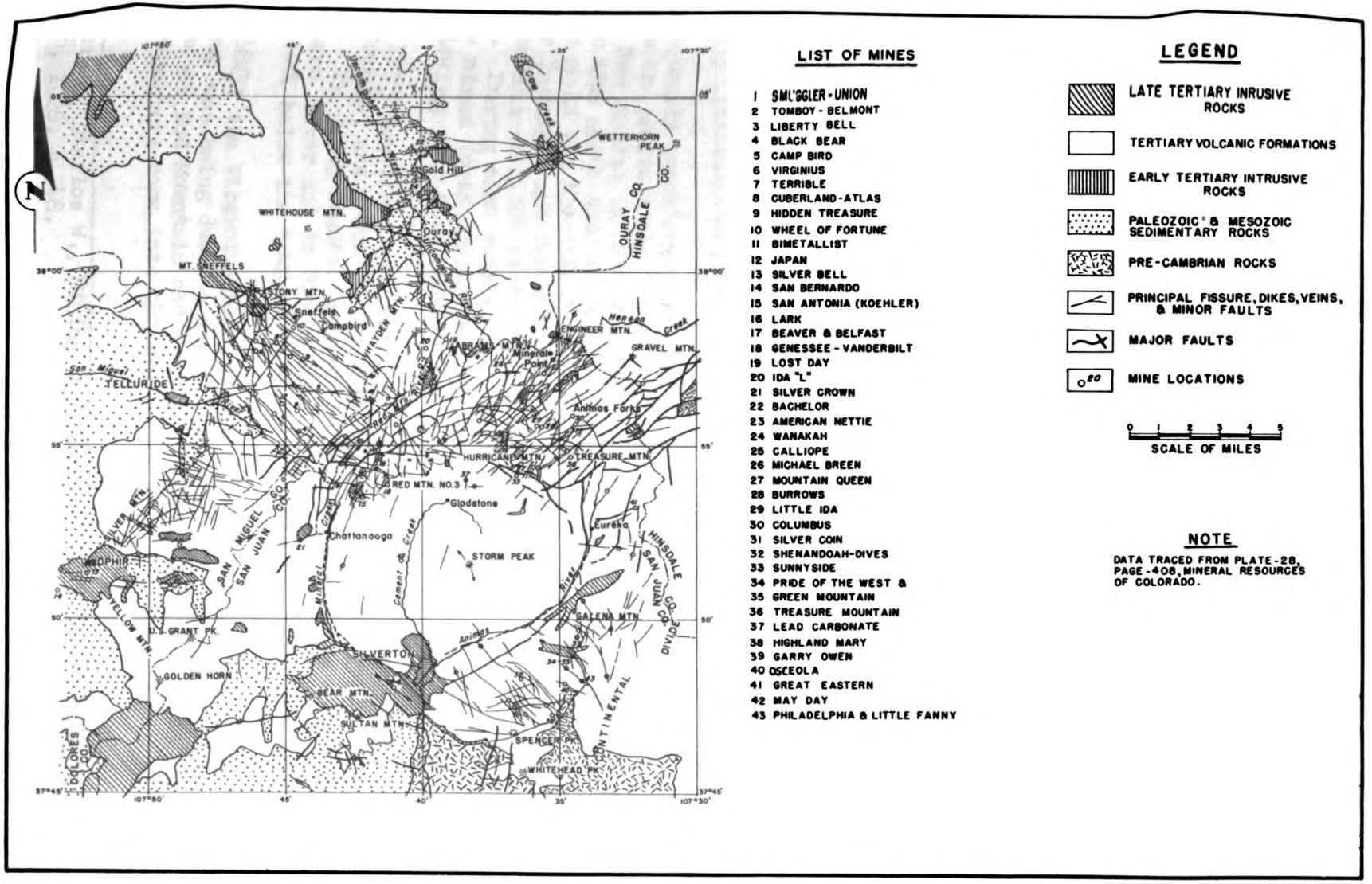

Figure 2. - General geologic map showing location of mines in San Juan Region, Colorado.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The area (fig. 3) is very poorly served by roads, except between Ouray, Silverton, and Telluride. A narrow improved but unpaved highway, U. S. 550, connects Ouray and Silverton by way of Red Mountain pass at an altitude of 11,000 feet. Although Telluride is only 10 miles in a direct line from Ouray, it is necessary to travel 53 miles over a graveled road by way of Ridgeway and Placerville to reach it. These highways are kept passable throughout the year. County- and company-maintained roads from the major towns and highways permit access to most of the operating mines; however, many smaller mines cannot operate during the winter because of snow. Aerial tramways at several mines serve to transport ore, men, and supplies between the mines and mills.

The area is served by narrow-gage railroads at Silverton, Ouray, and Telluride (fig. 3). A branch of the Denver, Rio Grande & Western extends south from Silverton to Durango and Alamosa. A branch of the Rio Grande Southern extends north from Ouray through Ridgeway to the standard-gage railhead at Montrose. A branch from Ridgeway extends to Telluride.

HISTORY AND PRODUCTION

According to Henderson,6/ the first white men to enter the San Juan Mountain region were a group of prospectors known as "Baker's party". They reached the Animas River in the summer of 1860 and located in Baker's park, now the site of Silverton. Overtaken by a hard winter and harassed by the Ute Indians, many perished, but the rest escaped over the mountains.

The early experience of Baker's expedition discouraged immediate further attempts to prospect the territory; however, a party sent out by Governor Pile of New Mexico in 1870 discovered and successfully operated the Little Giant on the north side of Arrastre Gulch. Twenty-seven tons of ore yielding $150 a ton in gold was treated in an arrastre. In 1874 a treaty was negotiated with the Indians, and the main rush to the area started, the result of which was an influx of 2,000 prospectors, and more than that many claims were located. During that year several hundred tons of gray copper and galena ore were mined (principally from claims on Hazelton Mountain) and treated the following year in a smelter that had been erected at Silverton.

In 1875 locations were made on what is now the Smuggler vein in San Miguel County, and a ton of ore worth $2,000 was shipped to a smelter at Alamosa. In Ouray County, prospectors were at work at the headwaters of Uncompahgre River and in Poughkeepsie Gulch, and in 1875 the Grand View claim was located below the town of Ouray.

By 1881 the Virginius mine, at the head of Canyon Creek, had two shafts, and mining was being done on three levels. In the same year discoveries were made at Red Mountain and Ironton, and during the succeeding 2 years many prospectors came into the area.

6/ Henderson, Charles W., Mining in Colorado: U. S. Geol. Surv. Prof. Paper 138, 1926, p. 48.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Numerous mills and smelters were erected in the Silverton-Ouray-Telluride triangle, but generally these were unsuccessful, and ores running less than $100 could not be marketed outside. The completion of the narrow-gage Denver & Rio Grande Railroad to Silverton in July 1882, and the completion of a smelter at Durango in the same year, made it possible to mine lower-grade ores, and mining was increased about tenfold in San Juan County from 1882 to 1885. The same developments were largely responsible for accelerated operations in San Miguel and Ouray Counties.

The history of the area from just prior to the beginning of the 20th century has been one of consolidation of a large number of small producing mines into a few large companies, connecting groups of properties by low-level tunnels to afford drainage and a more economical means of development and transportation, the establishment of larger, better-located milling facilities, and improved methods of treatment.

According to Henderson,7/ the first recorded production from Ouray County, in 1878, was $49,473 in silver and gold; the earliest production from San Juan County, in 1873, was $13,000 in gold; and the earliest production San Miguel County, in 1878, was $4,795 in silver. By 1885 the annual production of gold, silver, copper, and lead in the three counties reached a total value of $2,734,000. By 1890 the total value of these metals reached $6,000,000 and remained fairly constant until about 1900, when it reached over $8,000,000. It was not until the period between 1900 and 1910 that zinc was recovered and became an important source of income. During the period of 1900 to the depression in 1930, the total annual value of metal products fluctuated only slightly between $6,000,000 and $8,000,000. During the 30's, annual production remained around $1,000,000 to $2,000,000; however, a steady rise in production took place in the 40's and finally reached an annual value of $6,697,274 in 1947.8/

The following table gives the total production of gold, silver, copper, lead, and zinc in Ouray, San Juan, and San Miguel Counties from the earliest record to 1947, in terms of recovered metal.9/

7/ Work cited in footnote 6.
8/ Production statistics to 1930, U. S. Geol. Sur. Mineral Resources; 1931 to 1947, U. S. Bureau of Mines Minerals Yearbook.
9/ A. J. Martin, supervising engineer, Bureau of Mines, Statistics and Economics Division, Denver, Colo.

Generated on 2024-09-19 22:04 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Production of gold, silver, copper, lead, and zinc in Ouray, San Juan, and San Miguel Counties, Colo., 1873-1947

	Ouray, 1878-1947	San Juan, 1873-1947	San Miguel, 1875-1947	Totals
Gold				
Placer:				
Ounces	131	379	9,688	10,198
Value	$4,299	$13,161	$206,808	$224,268
Lode:				
Ounces	1,893,970	1,593,697	3,449,412	6,937,079
Value	$40,894,877	$37,099,605	$75,396,014	$153,390,496
Total gold:				
Ounces	1,894,101	1,594,076	3,459,100	6,947,277
Value	$40,899,176	$37,112,766	$75,602,822	$153,614,764
Silver				
Ounces	44,961,170	41,195,314	52,132,431	138,288,915
Value	$34,500,109	$28,094,036	$37,946,151	$100,540,296
Copper				
Pounds	27,908,561	78,444,618	23,268,666	129,621,845
Value	$3,892,483	$11,203,689	$3,745,711	$18,841,883
Lead				
Pounds	181,270,150	516,046,695	263,258,690	960,575,535
Value	$8,597,599	$29,259,204	$15,598,458	$53,455,261
Zinc				
Pounds	7,780,250	235,712,284	35,467,182	278,959,716
Value	$823,069	$16,546,048	$3,235,726	$20,604,843
Total value	$88,712,436	$122,215,743	$136,128,868	$347,057,047

Generated on 2024-09-19 22:02 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from THE OHIO STATE UNIVERSITY

GENERAL GEOLOGY

The geology of the mineral productive area of Ouray, San Juan, and San Miguel Counties (fig. 2) has been mapped and described by numerous investigators.10/ The information herein contained has been extracted from a report by Vanderwilt,11/ which is a compilation of geologic information from the other sources.

10/ Irving, J. D., Ore Deposits of the Ouray District, Colorado: U. S. Geol. Surv. Bull. 260, 1905.
Cross, W., Howe, E., and Irving, J. D., U. S. Geol. Surv. Atlas, Ouray Folio No. 153, 1907.
Bastin, E. S., Silver Enrichment in the San Juan Mountains, Colorado: U. S. Geol. Surv. Bull. 735, 1923.
Burbank, W. S., Revision of Geologic Structure and Stratigraphy in the Ouray District, Colorado: Colo. Scien. Soc. Proc., vol. 12, No. 6, 1930.
Burbank, W. S., Structural Control of Ore Deposition in the Uncompahgre District, Ouray County, Colorado: U. S. Geol. Surv. Bull. 906-E, 1940, pp. 189-265.
Purington, C. W., Preliminary Report on the Mining Industries of the Telluride Quadrangle, Colorado: U. S. Geol. Surv. 18th Annual Report, Pt. 3, 1898, pp. 751-848.
Cross, W., and Purington, C. W., U. S. Geol. Surv. Geol. Atlas, Telluride Folio No. 57, 1399.
Spurr, J. E., The Camp Bird Compound Vein-Dike: Econ. Geol., vol. 22, 1925, pp. 126-137.
Purington, C. W., Ore Horizons in the Veins of the San Juan Mountains, Colorado: Econ. Geol., vol. 1, 1925, pp. 129-133.
Moehlman, P. S., Ore Deposition South of Ouray, Colorado: Econ. Geol., vol. 31, 1936, pp. 377-397, 488-504.
Burbank, W. S., Structural Control of Ore Deposition in the Red Mountain, Sneffels, and Telluride Districts of the San Juan Mountains, Colorado: Colo. Scien. Soc. Proc., vol. 14, No. 5, 1941.
Ransome, F. L., Economic Geology of the Silverton Quadrangle: U. S. Geol. Surv. Bull. 182, 1901.
Burbank, W. S., Vein Systems of the Arrastre Basin and Regional Geologic Structure in Silverton and Telluride Quadrangles, Colorado: Colo. Scien. Soc. Proc., vol. 13, No. 5, 1933.
Chase, Charles A., A Geological Gamble in Colorado Meets with Success: Eng. and Min. Jour., vol. 128, 1929, pp. 202-205.
Cross, Whitman, Howe, Ernest, and Ransome, F. L., U. S. Geol. Surv. Geol. Atlas, Silverton Folio No. 120, 1905.
Pride of the West, Inc., Silverton, Colo.: Colo. Mining Assoc. Mining Yearbook, 1946, pp. 81-82.
Highland Mary Mines, Inc., Silverton, Colo.: Colo. Mining Assoc. Mining Yearbook, 1946, pp. 83-84.
Purington, C. W., Treasure Mountain, Colorado: Min, and Scien. Press, vol. 97, 1908, pp. 23-25.
Hulin, C. D., Structural Control of Ore Deposition: Econ. Geol., vol. 24, 1929, pp. 15-49.

Generated on 2024-09-19 22:05 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Footnotes (Cont'd.)

Burbank, W. S., The Manganese Minerals of the Sunnyside Veins, Eureka Gulch, Colo.: Am. Mineralogist, vol. 18, 1933, pp. 513-527.
Prosser, Warren C., Tungsten in San Juan County, Colo.: Eng. and Min. Jour., vol. 90, 1910, p. 320.
Varnes, D. J., and Burbank, W. S., Lark Mine, Cement Creek Area, San Juan County, Colo.: Colo. Mining Assoc. Mining Yearbook, 1945, p. 36.
Kelley, V. C., Geology, Ore Deposits, and Mines of the Mineral Point, Poughkeepsie, and Upper Uncompahgre Districts, Ouray, San Juan, Hinsdale Counties, Colo.: Colo. Scien. Soc. Proc., vol. 14, No. 7, 1946.

11/ Vanderwilt, John W., Mineral Resources of Colorado: State of Colorado Mineral Resources Board, 1947, including:
Burbank, W. S., Eckel, E. B., and Varnes, D. J., The San Juan Region, pp. 396-408.
Burbank, W. S., Early Tertiary Ore Deposits, Uncompahgre (Ouray) District, Ouray County, pp. 409-414.
Late Tertiary ore deposits:
Burbank, W. S., Districts of the Silverton Volcanic Center, p. 419.
Burbank, W. S., Telluride and Sneffels District, San Miguel and Ouray Counties, pp. 421-424.
Varnes, D. J., South Telluride Area, San Miguel County, p. 424.
Varnes, D. J., Iron Springs Mining District, San Miguel County, pp. 425-427.
Varnes, D. J., Mount Wilson District, San Miguel County, p. 428.
Burbank, W. S., Red Mountain District, Ouray County, pp. 428-437.
Varnes, D. J., South Silverton Area, Animas District, San Juan County, pp. 431-433.
Burbank, W. S., Eureka and Animas Forks Area, Eureka District, San Juan County, pp. 433-435.
Varnes, D. J., and Burbank, W. S., Cement Creek and Mineral Creek Areas, Eureka District, San Juan County, pp. 435-437.
Burbank, W. S., The Mineral Point, Poughkeepsie, and Upper Uncompahgre Districts, San Juan and Ouray Counties, pp. 437-439.

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The ore deposits are chiefly veins in strongly fissured and slightly tilted volcanic rocks, which form a blanket 4 to 6 thousand feet thick on the Telluride erosion surface. *** the volcanic rocks are underlain along their west border by Paleozoic and Mesozoic sedimentary rocks and to the east by pre-Cambrian metamorphic rocks. The entire section of rocks was intruded by late Tertiary time by volcanic dikes and larger intrusive bodies. Radial and concentric fissuring occurred about a center of disturbance now marked by a down-faulted block or caldera about 8 miles in diameter.

The volcanic rocks at their base are separated from the older basement rocks by a layer of the Telluride conglomerate. In the eastern part of the area, where the volcanic rocks rest mainly on the pre-Cambrian basement, this layer of conglomerate is patchy and thin, but it thickens northwestward and in the Telluride quadrangle comprises a maximum thickness of 1,000 feet of sandstone, fine conglomerate, and shale. The lower part of the volcanic series consists of 3,000 feet or more of San Juan tuff, which is the host rock of a large number of the more highly productive vein deposits. This is a tuff-breccia of surprisingly uniform texture and composition, and, owing to its generally massive and highly indurated nature, it has reacted as a unit to fissuring forces. The continuity and uniformity of fissuring in this formation is an important factor in the productivity of many veins. The Smuggler-Union vein system in the Telluride district has been stoped nearly continuously in this rock for about 9,000 feet along the strike and through a vertical range of about 2,500 feet. Overlying the San Juan tuff is the Silverton volcanic series, a complex of latite, rhyolite and andesite flows, tuffs, and breccias, presumably erupted from large concealed vents in the general vicinity of the Silverton quadrangle. These rocks likewise have been highly productive; but, with the exception of the stronger fissures and faults, there is less continuity and regularity to the fissuring than in the San Juan tuff. Local erosion surfaces which are present throughout and at the base of the Silverton rocks are chiefly of local prominence. The San Juan tuff and Silverton volcanic series, which are confined as units to the western San Juan, are overlain by the Potosi volcanic series, one of the most widespread volcanic series of the San Juan region. The Potosi rocks here are chiefly quartz latite and rhyolite flows and breccias, and they are separated from the underlying volcanic formations by an erosion surface. The Potosi rocks have not been very productive in the western part of the San Juan Mountains, and many of the vein fissures feather out or become unproductive in this series.

Soon after the beginning of the eruptions that formed the Silverton volcanic series, a broad, craterlike depression was produced in the center of this series, probably in part bounded by faults and related to the eruptive centers below. Later

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

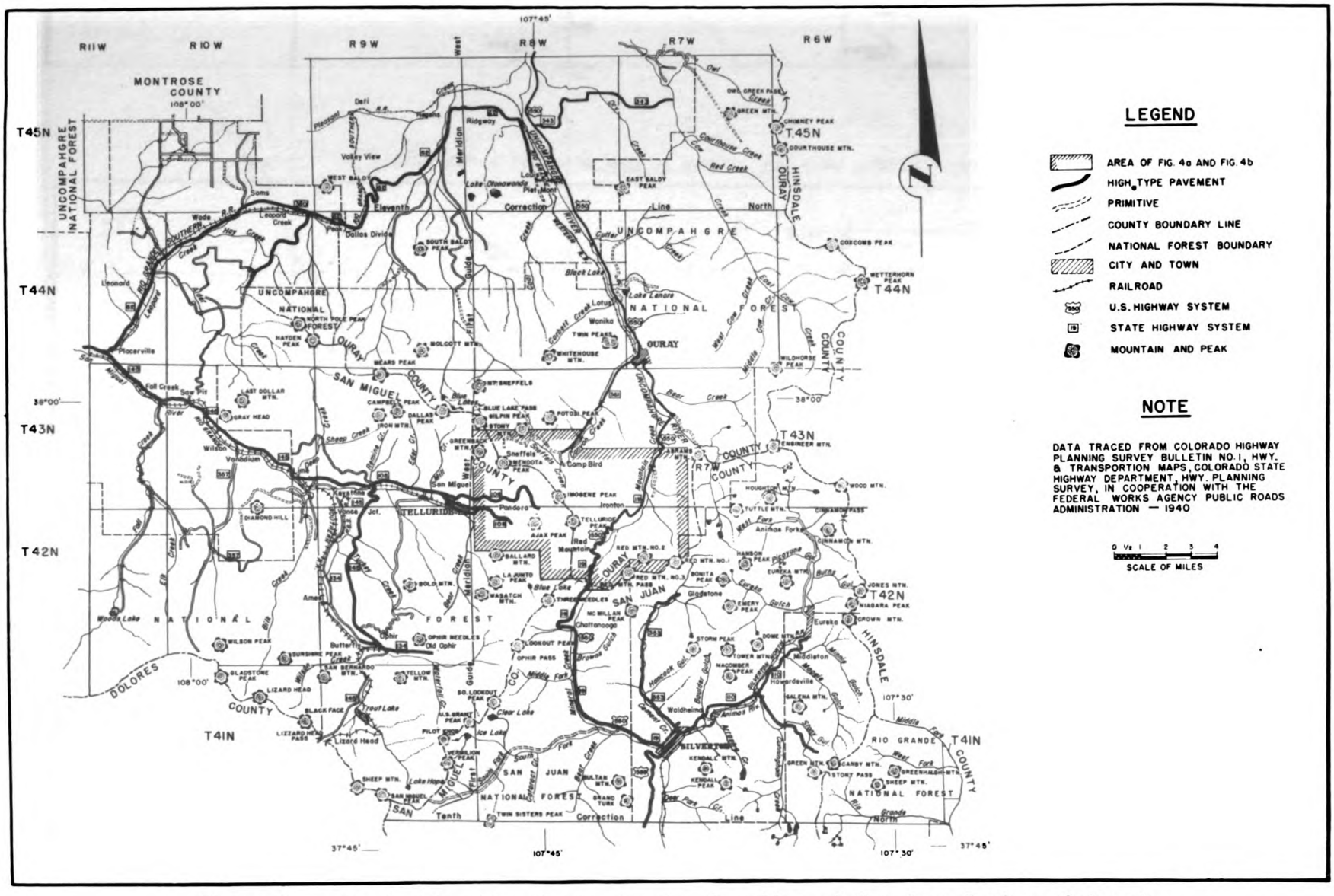

Figure 3. - Road and railroad map showing location of San Juan Region, Colorado.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

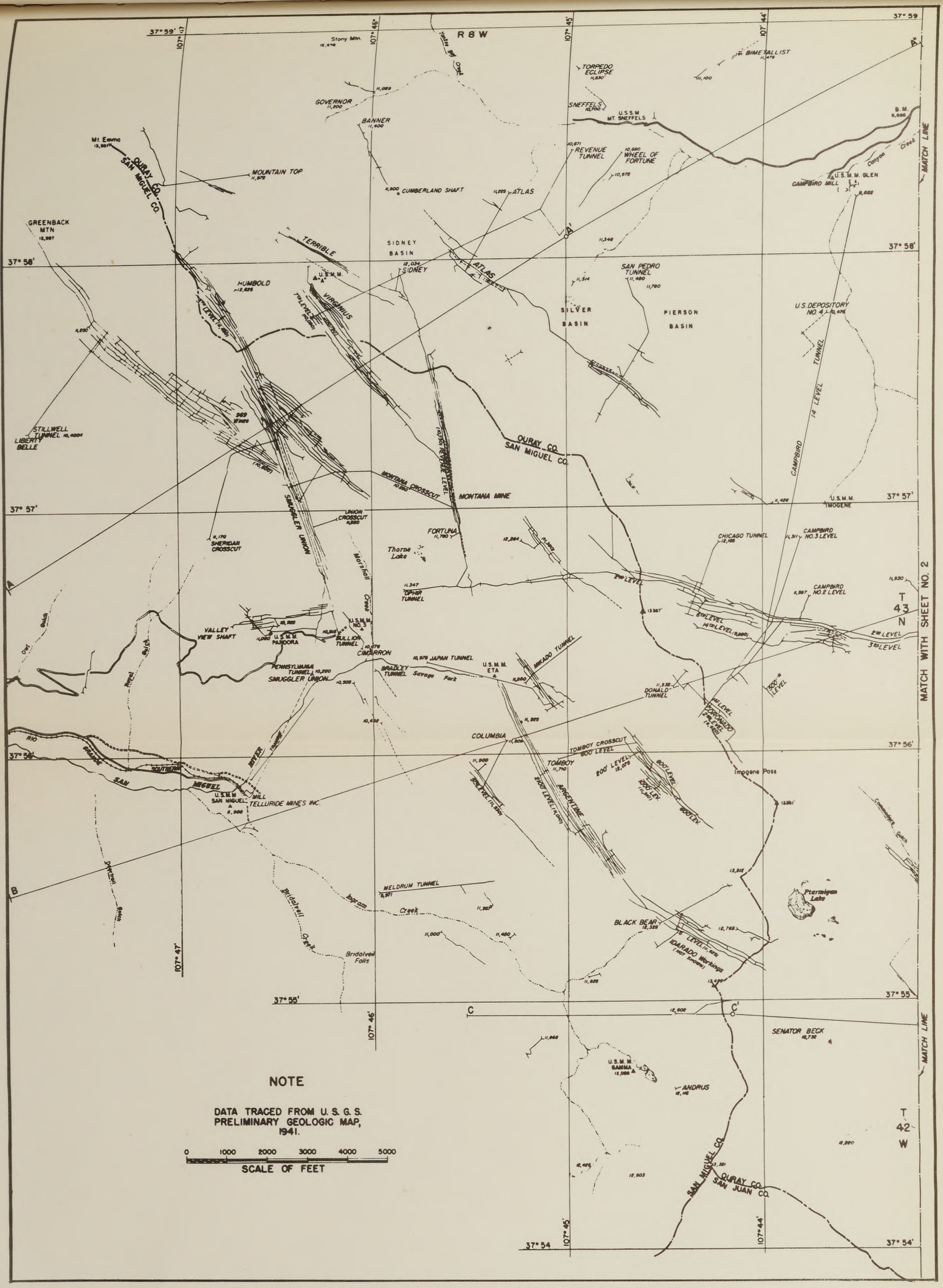

Figure 4a. - Location map of mines, San Juan Region, Colorado.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Figure 4b. - Location map of mines, San Juan Region, Colorado.

Generated on 2024-09-19 22:02 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
THE OHIO STATE UNIVERSITY

eruptions worked their way up around the borders and finally, probably after the flows of the Potosi volcanic series, strong curved faults formed around the margins, and a great central block about 8 miles in diameter subsided several thousand feet. During this subsidence, large intrusive bodies penetrated the volcanic rocks, possibly even doming them temporarily, and produced a complex system of concentric and radial dikes and fissures. As the intrusive bodies cooled and subsidence continued, further slight fissuring occurred, either along dikes of the earlier intrusive epoch or by further division of rock bodies. The ore-forming solutions rose into these fissures in several stages that were separated by renewed slight reopenings of the fissures and produced the ore-bearing veins. Along the borders of the subsided area the ore solutions followed up or along or near volcanic pipes and breccias or along intersecting fractures and produced some ore bodies in the form of chimneys or pipes. Such areas were generally subjected to strong fumarolic alteration by hot waters and gases of volcanic origin. Only in one area, at Red Mountain, along the west margin of the caldera, however, have the chimney ore bodies proved to be very productive.

The general features of the geology and pattern of the fissuring are shown on figure 2. The relatively small number of fissures shown in many of the areas of the map is not truly representative of the actual conditions, as only districts on the north and northwest and a small area southeast of Silverton have been mapped in comparable detail.

MINING OPERATIONS

Sneffels-Telluride Area

The area north and west from Red Mountain, including Sneffels and Telluride, is frequently designated as the northwest exterior portion of the Silverton caldera (figs. 2, 4a, and 4b).

General Description of the Deposits

According to Burbank,12/ the veins of the area can, in general, be classified into three principal types, though there are some local irregularities. The vein group is characterized by curving fractures that converge about the Mt. Sneffels intrusion at their northwest end and terminate against or interlace with the bounding faults and fractures of the Silverton caldera. The oldest fissures are believed to be those occupied by dikes, which in general follow curving courses. Some of these dikes do not extend to the surface. The Smuggler-Union, Montana, and Argentine, together with some other veins, follow the walls of dikes and form one of the principal productive groups. Another set of vein fissures, believed to be somewhat later in origin, have a more uniformly straight northwest course, and at some points they cut diagonally across or terminate against the curved fissures and dikes. These

12/ Work cited in footnote 11.

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

veins commonly dip southwesterly at lower angles than the others and are called "flat veins," although their dips are not generally less than 50°. The flat veins of the Smuggler-Union, Black Bear, Humboldt, and possibly the Liberty Bell are representative of this group. A few veins follow the walls of dikes that are concentric to or spiral outward from the volcanic center. They strike northerly and northeasterly across the other fissures and are considered to form a third class, but, except for the Camp Bird, which is a fault fissure, production from them has been small.

Telluride Mines, Inc.

The Telluride Mines, Inc. (figs. 2, 4a, and 4b), embraces the property of several formerly prominent operating organizations of the Telluride, Colo., district. H. S. Worcester is president and general manager, C. F. Parker, Jr., is mine superintendent, T. E. McCandless, chief engineer, C. V. Telk, superintendent of power, C. B. Nettleton, office manager, and John Ferguson, Jr. is in charge of mill and surface operations.

The company owns some 134 mining claims and holds long-term leases on over 100 others, representing the holdings of the Smuggler-Union, Tomboy, and Liberty Bell groups (figs. 4a and 4b), as well as others less prominently known. Many historic and technical articles have been published in the various trade journals, Federal Government, and Colorado State publications, so that only a few statements in regard to history should be sufficient.

The first locations were made on the Smuggler-Union vein in 1875, and 1 ton of ore worth $2,000 was shipped to the smelter at Alamosa, Colo. The Smuggler-Union suspended operation in 1923 after a production record of 52 years. The first operations of consequence on the Tomboy property were begun in 1896 by the English company, Tomboy Gold Mines. This company purchased the Montana property during 1912 and mined out the ore above the Revenue tunnel level, suspending operations in 1927 after recording a production of about $26,000,000.

The Liberty Bell mine, which produced only silver and gold, was operated from 1898 to 1921. One of the early direct cyanidation plants was placed in operation at this property.

The Veta Mines, Inc., acquired these properties, except the Liberty Bell, by 1936, reincorporating in 1942 as Telluride Mines, Inc. The Liberty Bell property was acquired in 1947.

The Telluride Mines, Inc., is the only operation in the San Juan area that is served by railroad facilities that permit handling freight cars in their mill building. The area is served by the narrow-gage Rio Grande Southern Railroad, and a stub extends from Telluride to the company's property (fig. 3). This road connects with the Denver & Rio Grande Western Railroad at Ridgeway, Colo., and affords access to the Utah and Montana mills and smelters and also the Arkansas Valley smelter of the American Smelting & Refining Co. at Leadville, Colo.

Generated on 2024-09-19 22:04 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The first successful long-distance transmission of electric power was accomplished in this district and was instrumental in permitting continuous operation by the early operating companies. The present company owns water rights on water from Blue Lake and is able to operate two hydroelectric plants with a combined capacity of 925 kw., except during the winter months. These plants "float" on the line of the Western Colorado Power Co., as the mine and mill require additional power, which is purchased from that organization.

The company also operates a sawmill about 30 miles from Telluride. Stumpage is purchased from private sources, and they now have several years' supply. One practice that might be worthy of mention is the sawing of slabs thicker than usual and using them for lagging in the mine.

Description of the deposits. - The ore deposits are found in a series of fissure veins containing some of the longest and deepest ore shoots in Colorado. The Smuggler-Union vein has been stoped continuously over a horizontal distance approaching 10,000 feet in length, and ore has been mined through a vertical distance greater than 3,000 feet. The Montana vein has been developed on the Pennsylvania level for a distance exceeding 4,000 feet, and on some of the upper levels it has been stoped for a length greater than 6,000 feet (figs. 4a and 4b). The production of the area has come principally from that portion of the veins within the San Juan tuff. The upper levels of some of the mines are within the Silverton volcanic series, which ranges between 200 and 800 feet in thickness.13/

The Telluride conglomerate forms the base of the Tertiary series and has been explored in only one place - the 696 winze in the Smuggler-Union mine below the Pennsylvania level, where the conglomerate was found to be 370 feet in thickness. According to H. S. Worcester, general manager, it was found to be lying on the McElmo formation of Upper Jurassic age, as designated by Cross.14/

In the later work by Burbank,15/ the McElmo formation is included in the Morrison.

According to Worcester, the ore continues to the bottom of the winze, with a width of 3 feet and the same base-metal content.

The veins containing the ore bodies consist principally of quartz or quartz-cemented breccia of altered andesite fragments, with some banding. There are varying amounts of rhodonite, rhodochrosite, and calcite, generally localized in the quartz gangue. The principal ore minerals are galena, sphalerite, and chalcopyrite, which, together with pyrite, are irregularly distributed through the vein filling. The silver ores of the Liberty Bell and other veins of that part of the district are chiefly argentiferous tetrahedrite, tennantite and galena, and some stephanite. Gold has been found in the "free" state in varying amounts throughout the mined area.

13/ Work cited in footnote 11.
14/ Work cited in footnote 10.
15/ Work cited in footnote 10.

3549

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

In general there is not much gouge on the walls of the veins, and in places they are "frozen." The operators have learned that in places the minerals in the walls are sufficiently high-grade to be classed as ore. This condition precludes the necessity of breaking only the vein material. The Ansborough vein is an exception and has a heavy gouge throughout most of its explored length. Throughout the mined area the veins ranged in width from 3 to 20 feet and probably averaged 6 to 7 feet.

A somewhat unusual feature of the Montana and Smuggler veins is the occurrence of black mineral oil or crude petroleum in vugs up to 8 or 10 inches long in the central part of the ore body. The oil flows rather freely, and when ore from this part of the mine enters the flotation plant it strangely does not affect flotation materially.

The average assays for 1906 to 1943 indicate the following grade: 1.96 percent lead, 0.57 percent zinc, 0.185 ounce gold, and 3.53 ounces silver per ton.

Development and mining. - The precipitous terrain is favorable to development by adits. Frequently these entrances are driven as crosscuts for exploratory purposes and to afford more favorable portal sites. During the early period of exploration and development, the Smuggler-Union vein was developed by several adits, some of the more important being the Humboldt, Union, Sheridan, Bullion, and Pennsylvania, the lowest at an altitude of 10,220 feet. Some of the well-known adits on the Montana and Argentine veins are the Sidney, Fortuna, Ophir, and Revenue by way of the Virginius vein. At present, the lowest working level of the Montana vein is the Montana crosscut level driven from the Pennsylvania level of the Smuggler-Union. The drainage tunnel now in progress from the tramway level of the mill, at an altitude of about 9,000 feet, has been driven (June 1948) to a point about 2,700 feet from the portal. It has intersected the Ansborough vein, and conditions were found to be about as expected at this point, and the material exposed cannot be classed as ore.

At present, the Telluride Mines, Inc., does not have any shafts in operation, but in the past a few interior shafts were used at some of the properties. The 696 winze, an interior shaft, is the only development below the Pennsylvania tunnel directly connected with operating levels. It is connected to mine workings to the 18th level and has been extended to the 20th level. The lack of labor during the wartime emergency forced suspension of these operations, and the shaft has been allowed to fill with water. The information obtained from the work was an important factor influencing the decision to drive the mill-level drainage tunnel.

Different organizations operating the mines of this group throughout the many years have developed and used systems to suit their individual needs or ideas. In some cases the levels were 100 feet apart vertically, and in others they were 125 and 150 feet. During the later years of operation, the levels have been spaced at 150 feet on the dip of the vein. On the Montana vein, the main haulageway on the Pennsylvania level has been protected by a 30-foot pillar. A drift is run at the top of the pillar, and stopes are opened from it. The stope lengths are set at 250 feet and are serviced by raises maintained at each end. The stopes are started immediately above the drift by back-stoping, after which the stulls, posts, and lagging are placed and chutes are built. The 30 feet of raise between the haulageway and the drift is used for storage. In general, the track is

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

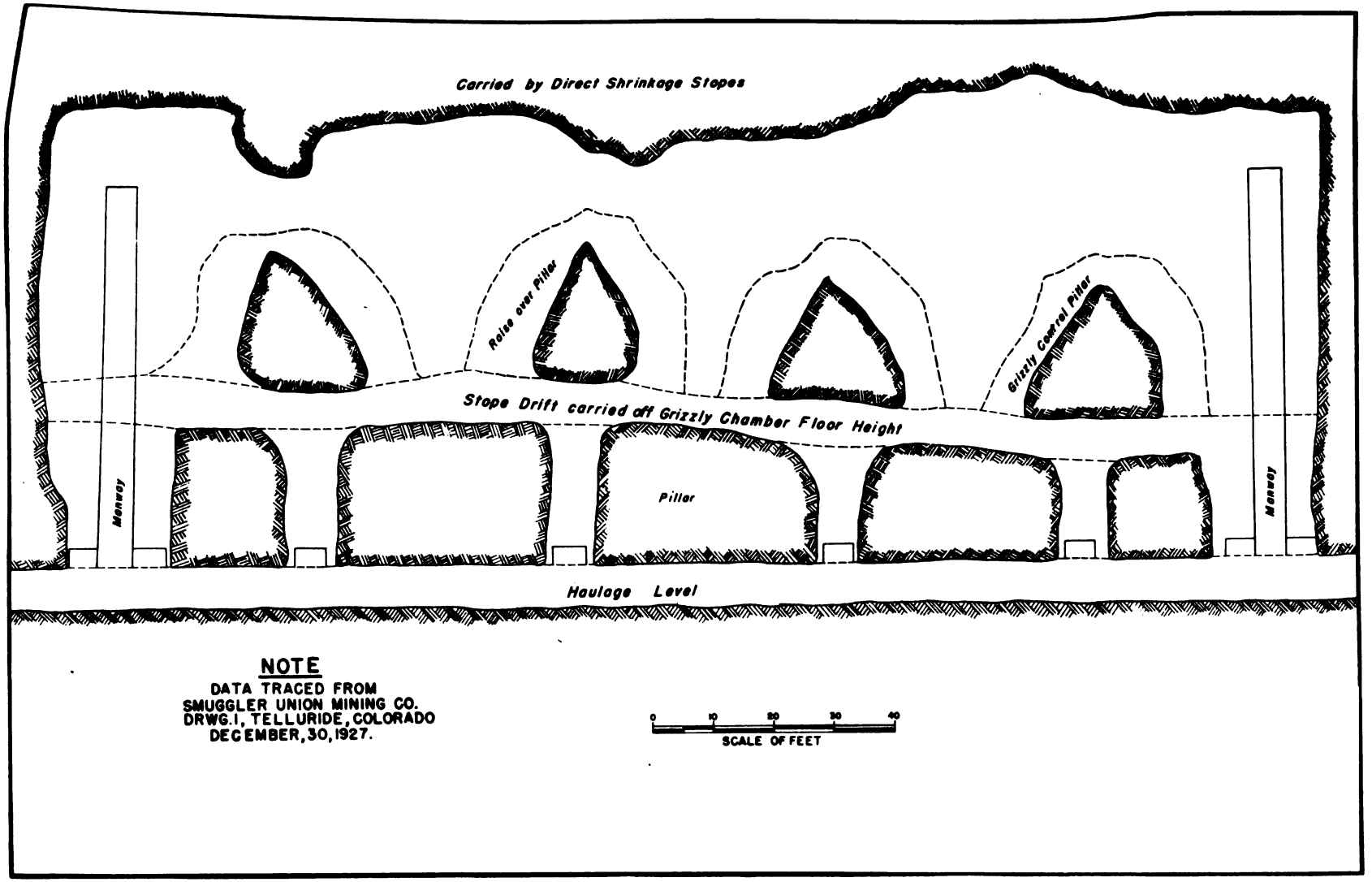

Figure 5a. - Longitudinal section of shrinkage stope, Telluride Mines, Inc.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

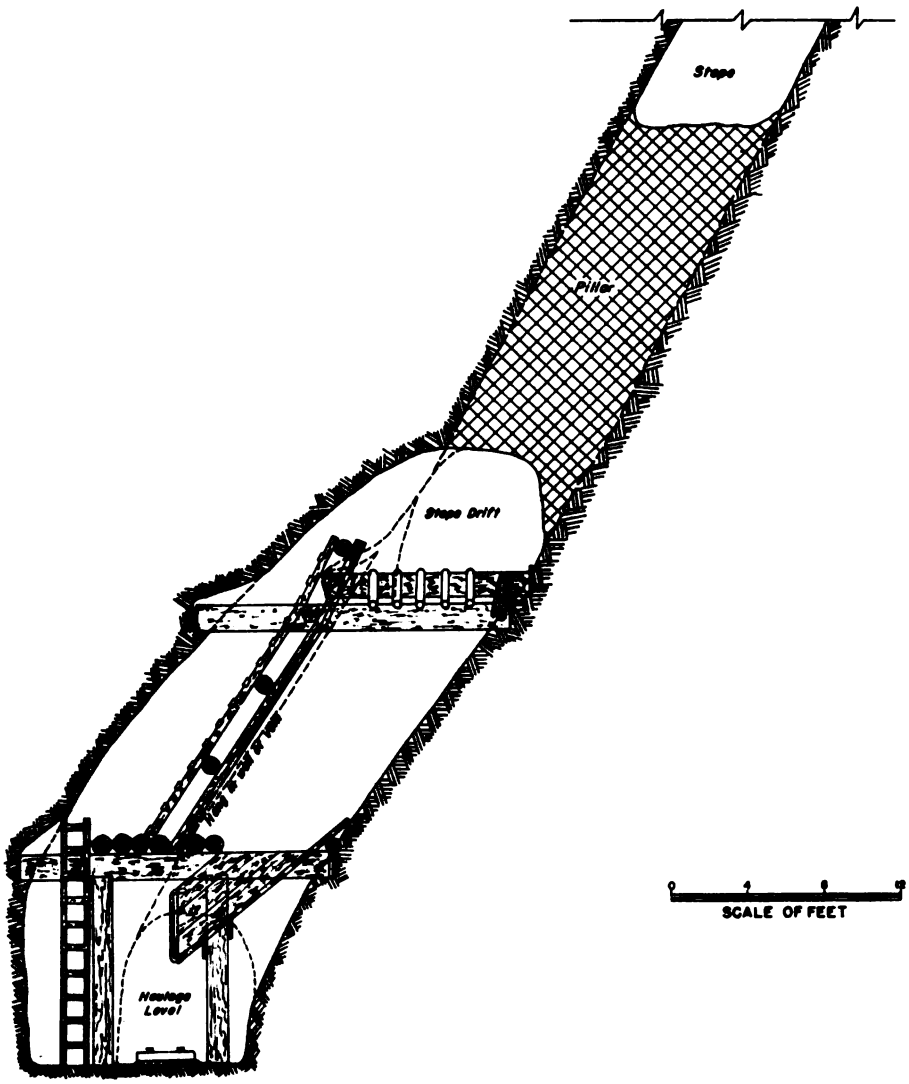

Figure 5b. - Cross-section through grizzly chamber, Telluride Mines, Inc.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

so laid that the grade favors the load for 125 feet each way from the service raise. In a few places it is necessary to tram the full distance of the stope, or 250 feet. The chutes are constructed on 20-foot centers on this level and are of the usual San Juan type, with a 2- by 12-inch slide gate. Tramming is done by hand, and end-dump cars of 1-ton capacity are used. Sill pillars will be left on stoping levels above the haulageway pillar. The system used on the Pennsylvania level of the Montana vein is also being used in opening the stopes of the Flat vein on that level.

The development drifts are all driven by contract, the company furnishing supplies and equipment, including mucking machines. The drift extending the Pennsylvania level southward on the Montana vein is currently in progress. The size of the drift is typical of those in which mechanical loading is used. The vein is wide enough to permit installation of chutes without breaking wall rock, which also permits use of the mucking machine. The empty cars are switched by use of an air-piston arrangement mounted on an overhead track commonly known as a "cherry picker." The crew mucks out the broken rock, drills, and blasts the round during one shift, which in this case is the night shift.

The ground is not difficult to drill or break, and the ordinary V-cut is in use. Drilling is done by two drifting machines equipped with automatic feed and chucked for 1-1/4-inch round steel. Compressed air used to operate air-driven equipment throughout the mine is furnished by 2,000- and 1,200-cubic foot compressors installed at the portal of the Pennsylvania tunnel.

Fuse and caps are used to detonate the powder in blasting throughout the mine.

During the later years of operation of the Smuggler-Union Co., a system of pillars and bulldozing chambers was instituted to facilitate extraction of ore from the Smuggler-Union vein. The system is illustrated and described on page 531, vol. 125, No. 13 of the Engineering and Mining Journal, from which excerpts have been taken:

> In opening a stope, the procedure was as follows: Manway raises are carried up and pockets started, beginning at No. 1. From the top of No. 1 pocket the stope drift is run in both directions, other pocket raises being carried up at the same time. As soon as the drift is broken through to the south manway, this is used for access to the drift, which is broken through to each raise in turn until the north manway is reached, the pockets being left full of ore. Then grizzly stulls and the upper portion of the grizzly are placed and the ore is drawn from the pocket to permit completing the lining down to the chute. After the grizzlies are in position, raises over control pillars are carried to open the stope, and these are followed by stoping to size.

Figures 5a and 5b show the stoping method. Throughout the stope above, pillars were left to support the walls. They were not left according to

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

any definite pattern, but at any point giving the least suspicion of possible trouble. The present operators are guided by past experience in the choice of stope preparation and apply the type best suited to needs of the ground at the location under consideration.

During the early operations it was considered necessary to waste-fill the stopes, but experience has shown that shrinkage stoping is better adapted to the ore deposits and less expensive. On the Montana and Smuggler-Union steep veins, pillars have been left where experience indicated the necessity. Some low-grade ore has been left as pillars, and in some places they have been mined years later. Shrinkage stoping also is used on the Flat vein, but it has been found necessary to support the hanging wall by pillars in some places, and in other places a system of half sets is used. In this system, stulls are set from the foot to the hanging walls, and the posts are placed between the stulls as close to the hanging wall as possible. The girths or spreaders between the hanging-wall ends of the stulls are also set as close to the hanging wall as possible.

Drilling in the stopes is done by heavy, self-rotating stopers chucked for 1-inch quarter-octagon steel. Conventional steel is in use generally, but detachable bits are used on developments that are being pushed above normal rates. Two machines are generally used in each stope. The ore is broken on a contract basis, and, in general, three men work together in the stope. Two miners operate the drills and blast the rounds, and a third man is responsible for pulling the chutes to lower the top of the broken ore to the level desired by the miners. This man assists his partners by helping with supplies, which the company delivers to the bottom of the hoist-equipped service raise. He also helps with any other part of the work as time permits. Contracts of this type are used wherever possible, making the contractors responsible for breaking the ore fine enough to pass through the chute gates. At the present time the company is mining from a sufficient number of stopes so that it is not necessary to double-shift the work. The double shift is a source of contention, especially in case of difficulty or delay by one shift.

Formerly the stopes were drawn empty and cleaned before being abandoned. Now the stopes are drawn empty but are not cleaned.

The Pennsylvania level is the principal haulageway for the mine and will be continued as such until the drainage tunnel at the mill level is put into operation. The level is trolley-wire equipped throughout, and a feeder wire is used because of the distance to the faces of the Montana level drift. A motor generator set is used to produce direct current at 250 volts. Heavy trolley locomotives capable of hauling 15 to 20 cars of 2-ton capacity are used for transporting ore. Locomotives of smaller capacity are used by repair crews, for gathering purposes and for switching cars behind mucking machines.

Hand-tramming is employed to draw ore from stopes above the haulage level and, after experience, the 1-ton capacity end-dump car was adopted for this purpose.

Generated on 2024-09-19 22:08 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

A special type of side-dump car has been developed for use on the main haulage. These cars were developed because of the large quantity of water coming through the ore passes during the spring and early summer run-off of melting snows. These cars may be classed as a sort of tub, as they have no openings or doors and are emptied in much the same manner as the Granby-type car. The cars are drawn past the crusher-bin dumping point, and a hinged cradle is so placed that it will prevent the wheels on the side opposite the dump from leaving the track. The piston rod of an air piston is hooked into an eye welded to that side of the car, and by the application of compressed air to the piston the car body is tipped on the hinge until dumped. The body is then tipped back into place by the piston. It is also possible to partly raise the body and let it drop back to the dumping position in order to shake loose sticking material. The cars are dumped rapidly by two men; one operates the air piston and the other operates the locomotive. When the train has been dumped, the hinged cradle is dropped away from the track, and the train is ready for another trip. As the tramming is done on contract, very little time is consumed by the train crew.

The chutes installed at the ore passes for loading the train are of wood construction and are typical of those used at other operations in the San Juan region. The gate consists of a single 2- by 12-inch plank 8 to 10 feet in length, held in place by a piece of 1-1/2 inch pipe flattened at the bottom, bent, and attached to the bottom of the side of the chute. In some cases the top end is flattened, and in some it is not, but in all cases the top is fastened to the timber to which the sides of the chute are fastened. Sufficient space is left between the ends of the chute sides and the pipe to allow the plank to slide up and down when in use. To operate the gate, one end is held in place by a wire, cable, or piece of chain, and the other is raised or lowered to allow the broken material to run into the car. This gate can be operated from either end and is usually handled by one man. It is simple, effective, and easily replaced.

No scrapers are used in the mine, and all loading is from chutes or by mucking machines, except for clean-up work.

After being dumped into the crusher bin, the ore is crushed and delivered to the tramway bin and thence by continuous aerial tram to the mill about 3,000 feet distant and 1,200 feet lower in elevation.

Men and supplies are also transported between the mill and the mine by this method, as the mill is the point nearest the mine accessible to automotive transportation.

Idarado Mining Co.

The Idarado Mining Co., Ouray, Colo., is controlled by the Newmont Mining Co., 14 Wall Street, New York City, and represents a consolidation of a number of mining properties situated in the Red Mountain, Sneffels, and Telluride area of Colorado. The group (figs. 2, 4a, and 4b) is comprised of some 288 mining claims, including the Black Bear, Barstow, and Imogene mines as well as the Meldrum tunnel and numerous claims covering outcrops of less importance at this time.

Generated on 2024-09-19 21:54 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The properties are on or near the divide between the San Miguel and Uncompahgre River drainage, about 4 miles southeastof Telluride, Colo., about 2 miles, air line, from the surface plant of the Telluride Mines, Inc. The region is extremely rugged, with deep canyons and ridges exceeding 12,000 feet in altitude, a terrain favorable to numerous snowslides. These conditions, together with difficulty experienced in milling the ore, were caused contributing to the cessation of operations at the Black Bear mine during 1924.

Those in charge of operations are Fred Wise, general manager, John S. Wise, mining engineer, Richard Unger, mill superintendent, George Murray, superintendent, and Richard Leber, mine foreman.

Description of the deposit. - The Black Bear is one of the "flat vein" system, which includes the Flat vein of the Smuggler-Union, the Humboldt, and possibly the Liberty Bell (figs. 4a and 4b). The vein varies considerably in both strike and dip, but the general course is about N. 60° W. and averages about 60° in dip. The Black Bear fracture crosses the Argentine dike, but development has not yet proved the economic aspect of this portion of the vein. Like other veins of the system, it varies considerably in width, but it is expected that the mined areas will average from 5 to 7 feet, while there are minable zones which reach 20 feet in width.

The mineral deposit likewise is similar to that of the other veins of the "flat" system and comprises principally quartz or quartz-cemented breccia containing pyrite, sphalerite, galena, chalcopyrite, gold, and silver. There is also a minor amount of the manganese mineral rhodonite. Mining operations above the Treasury tunnel level indicate that the mineralized zone of economic grade is more or less lenticular in outline. The lenses vary in size and may be isolated from each other.

The Idarado Co. has not operated on the Handicap, Coronado, or St. Paul veins, although the Barstow mine, in Commodore Gulch, has developed the latter vein to some extent. The Handicap is considered to be the southeasterly extension of the Tomboy vein, and similar mineral deposits are to be expected. Likewise, no work has been done on the Barstow vein, but to the southwest the Columbia, Ajax, and Ida veins have been intersected by crosscutting. Favorable conditions have been exposed, but development will be necessary before an appraisal can be made.

The Treasury tunnel was started in rocks of the Silverton volcanic series and entered the San Juan tuff at about its intersection with the Handicap vein. Production from the properties of the Telluride Mines, Inc., and the Camp Bird have been from the San Juan tuff, and conditions similar to those at the Camp Bird have been indicated by development completed on the Black Bear vein.

Development and mining. - The Idarado operations are in the development stage and the methods of mining will be modified according to conditions encountered. The limited amount of mining is illustrated on figure 6, a longitudinal section in the plane of the Black Bear vein. The early operations of the Black Bear mine in Ingram Basin were at altitudes of

Generated on 2024-09-19 22:07 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

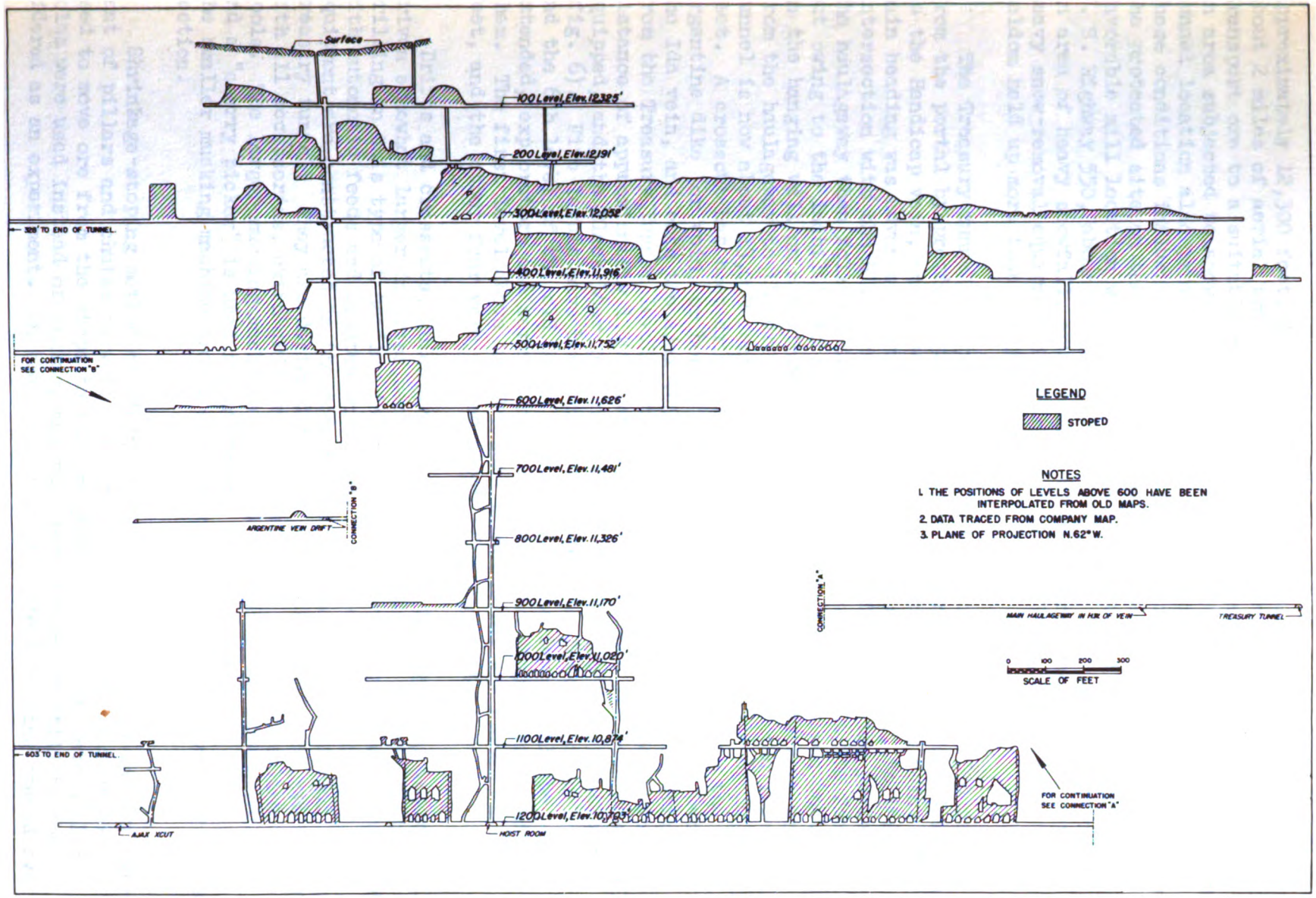

Figure 6. - Longitudinal section, Idarado Black Bear mine.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

approximately 12,300 feet, in an area seriously hampered by snowslides. About 2 miles of aerial tramway was required to service the mine and transport ore to a suitable mill location. The tramway also traversed an area subjected to snowslides, which caused serious damage. The Meldrum tunnel location also proved too hazardous because of these avalanches. These conditions influenced the decision to drive the Treasury tunnel from the protected site on the Uncompahgre drainage side of the divide. A favorable mill location was also available adjacent to the portal site on U. S. Highway 550, about 10 miles south of Ouray. This highway traverses an area of heavy snowfall, and a number of slides run each season, but heavy snow-removal equipment is maintained by the State, and traffic is seldom held up more than a day at a time.

The Treasury tunnel had been completed to a point about 5,500 feet from the portal by previous operators of the property. It afforded access to the Handicap vein, and by way of a crosscut to the St. Paul vein. The main heading was advanced on the same course, almost due west, to its intersection with the Black Bear vein about 8,660 feet from the portal. The haulageway then followed the course of the vein for about 500 feet, but owing to the inability to maintain a straight course, it was continued in the hanging wall on a northwesterly bearing, and crosscuts were driven from the haulageway to the drift on the vein. The breast of the Treasury tunnel is now about 13,000 feet from the portal at an altitude of 10,704 feet. A crosscut has been driven to the southwest, intersecting the Argentine dike (or vein, or both), the Columbia dike (or vein, or both), the Ida vein, and both the Ajax vein and dike. A raise has been driven from the Treasury tunnel level to the 6th level of the Black Bear mine, a distance of approximately 1,100 feet. The raise has not yet been completely equipped, and the Black Bear workings are not accessible for operations (fig. 6). Five levels have been started between the Treasury tunnel level and the 6th level of the old Black Bear mine. These levels will be extended, exploratory and service raises driven, and stopes opened from them. The first level above the Treasury tunnel level was spaced at 200 feet, and the other four were spaced about 175 feet apart.

Drifts and crosscuts, which are to be used as haulageways, are generally driven somewhat larger in cross section to permit use of larger equipment. Drilling in this type of heading is done by four drifting machines equipped with automatic feeds and mounted on a jumbo. All jumbos and similar equipment are constructed in the company machine shops at the portal of the Treasury tunnel. They are designed to suit particular needs and are equipped with all accessories, extra drill rods, bits, spare drill parts, and hand tools. The larger mucking machines are used to handle the broken rock, and a "cherry picker" is used for switching cars. A 2-machine jumbo and the smaller mucking machine are used in driving drifts of the smaller cross section.

Shrinkage-stoping method of mining has been employed, and the arrangement of pillars and chutes is well illustrated in figure 6. A scraper was used to move ore from the stope to the ore pass on the 1,000 level. Draw holes were used instead of chutes, and the operation might still be considered as an experiment. On the 900 level the stope was being opened by

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

back stoping followed by the installation of stulls, lagging, and chutes. A mucking machine is used for cleaning up after such operations.

Drilling in the raises and stopes is done with conventional rotating stoper drills, except in one stope, in which a diamond drill was in use.

Experimental work in connection with blast-hole diamond drilling has been carried on by the Idarado Co., in cooperation with Boyles Bros. Drilling Co. of Salt Lake City, Utah. The results indicate that the narrow vein can be mined economically by this method. At the outset, Mr. Ducharme of the Idarado Co. engineering staff, was assigned to work with Boyles Bros. Drilling Co. representatives in solving the problems arising from the operation. Information concerning the work was made available by the staffs of the Idarado Co. and Boyles Bros. Drilling Co. a short time prior to its release through the Explosives Engineer.16/

The first ore mined by this method was in the form of a somewhat irregular pillar. Examination of the ore body disclosed conditions generally considered prohibitive to economical mining by the diamond-drill blast-hole method. The irregularity of the vein in both dip and strike prevented placing holes close to either wall. Mud seams some 12 inches wide crossed the vein on irregular courses and at various angles, so that occasionally the hole would be in mud for several feet. Vugs of various sizes were sporadically dispersed through the ore body, some were filled partly or completely with quartz crystals, whereas others were void. A redeeming feature, however, was the strong walls which were not easily caved and were well adapted to shrinkage stoping.

It was at first believed that the mud seams, vugs, and fractures would aid in the breaking; however, the assumption proved erroneous. These structural features allowed the gases to dissipate, lessening the shock upon detonation.

The first holeswere drilled horizontally and 50 feet in length, approximately the maximum distance through which holes can be maintained in the proper position owing to local irregularity of the vein. Throughout this pillar the vein averaged 5-1/2 feet in thickness. Experimental shots indicated that with about 3 feet of burden on the holes, the ore broke in the form of a V, leaving ore on both the hanging and footwalls. An experimental shot with 4-1/2 feet of burden on the hole and 0.58 pound of powder per ton, broke the ore clean from both walls, and subsequent work has been done on that basis.

Mining was continued in this manner until the sublevel drift at the top of the pillar was reached. The balance of the pillar was mined by down holes drilled at the inclination of 70°, the dip of the ore body at this location. The same burden, 4-1/2 feet, was used on the down holes with equal success.

16/ Fox, R. H., Long-Hole Diamond Drilling in Narrow Ore Bodies: The Explosives Engineer, vol. 26, No. 2, p. 44, March-April 1948.

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The favorable results obtained in mining the pillar suggested that the work should be expanded, and operations were transferred to a stope. This stope was 140 feet in length, and as the practical length of drill holes appeared to be 50 feet, it was decided to use the shrinkage method of mining. At this stope, no sublevel within the 50-foot distance was available, and all holes were drilled horizontally. The set-up on broken ore was satisfactorily achieved by use of the Fowler air bar. Experience indicated that the 4-1/2-foot burden was the maximum that could be expected with a 2-inch hole. Without doubt, more ore could have been broken with a larger hole, but it would have been less economical.

The ore body widened to 19 feet and was broken by placing 6 feet of burden on three holes drilled as nearly parallel as possible. The wider parts of the ore body are not as "tight," and, owing to irregularity of the footwall, occasional pieces of ore are left on it, and it is necessary to mine them with a conventional stoper or short diamond-drill holes. These pieces must be mined before the next ring is blasted, as they increase in size with the succeeding rings.

The abrasive character of the rock precluded the use of plug bits for drilling the 2-inch holes. Core bits and 5-foot double-tube core barrels are used exclusively.

The mud seams and vugs presented a serious problem respecting placing powder in the holes. To overcome the condition, jointed brass tubing is first inserted to the bottom of the hole and withdrawn as the hole is loaded. A longer time is required when this method is necessary, but the powder is placed satisfactorily. Some semigelatin powder was used experimentally, but the practice has been discarded in favor of a 60-percent special gelatin. The powder is detonated by primacord whenever holes have penetrated bad ground or when there is more than one hole in the ring.

Chute-drawn stopes always raise the problem of secondary breakage to a greater extent than other types of draw. No trouble was experienced in this respect while the narrow vein was being mined, but some secondary blasting was necessary when mining the wider zones. This condition could be eliminated to a considerable extent by using draw holes and slushers, by installation of bulldozing chambers or a grizzly system.

Additional experimental work probably will result in some changes in practice, but the arrangement of a stope designed especially for that type of mining probably would increase production materially. It is essential that the drill be maintained in operation for the maximum amount of time. Information obtained to date indicates that this type of deposit can be mined successfully and economically by this system.

Haulage. - The small size and grades, ranging from 0.50 to almost 2 percent in the first 4,500 feet of the Treasury tunnel driven many years ago precluded the safe use of trolley locomotive haulage. The problem was solved by the installation of a Diesel mine locomotive, the description and operation of which is described by Harrington and East.17/

17/ Harrington, D., and East, J. H., Jr., Diesel Equipment in Underground Mining: Bureau of Mines Information Circular 7406, pp. 32-36, April 1947.

3549

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The locomotive is equipped with Westinghouse air brakes and two hand-operated emergency brakes. The air brakes are on the driving disks; one emergency brake is on the four brake shoes that contact each wheel, and the other brake is on the transmission.18/

The Diesel locomotive was placed in operation while the tunnel was being ventilated by means of a suction fan at the surface and an 18-inch steel pipe. A booster fan situated 8,500 feet from the portal was used to aid the system. The problem of conditioning the exhaust gas was effected by an unusual type of conditioner or scrubber developed for this locomotive.19/

Three tests by the Bureau of Mines on air conditions while the Diesel was in operation and while the tunnel was still a dead end indicated the absence of carbon monoxide, and only 17, 13, and 28 parts per million, respectively, of oxides of nitrogen were present. The American Standards Association has set 40 parts per million of oxides of nitrogen as the maximum allowable safe concentration or combination of oxides of nitrogen. However, the connection between the Treasury tunnel and the lower workings of the Black Bear mine has been completed, and ventilation of a large portion of the mine is no longer a problem. The 18-inch pipe and auxiliary fan have been removed from the tunnel.

Operation of the Diesel locomotive has been entirely satisfactory, and a Plymouth locomotive has been added to the mine equipment. It is powered by a 4-cycle, 6-cylinder Diesel motor rated as 73 bhp. at 1,000 rpm. at sea level, which is equivalent to 51 bhp. at 10,600 feet altitude.

Battery locomotives are used for gathering purposes on the Treasury tunnel level and for switching and tramming from crosscuts and drifts. Their use on levels above the haulageway will depend on conditions encountered. Trains are made up near the point at which the Treasury tunnel intersects the Black Bear vein, and a Diesel locomotive is used for hauling them to the surface. Battery-charging equipment will be installed at the underground shop now under construction. Air compressors also will be installed in this shop, and plans are in preparation for building the crushing plant underground.

Arrangements have been made with the Denver & Rio Grande Railroad whereby they receive concentrates for shipment at the mill bin. These concentrates are transported by the railroad company-owned Diesel-powered trucks to the standard-gage railhead at Montrose. Supplies and equipment destined for the mine are delivered to the property by these trucks. This arrangement eliminates the need for transhipment by the narrow-gage railroad between Montrose and Ouray, Colo., a distance of about 35 miles.

18/ Ruth, Joseph P., Ruth Diesel Locomotive Speeds Ore Haulage, 11,000 Feet Altitude: The Mines Magazine, vol. XXXV, No. 7, 1945; also ref. cited in footnote 17.

19/ Plumb, C. W., Diesel Locomotive for Underground Haulage: Am. Min. Eng. Journ., vol. 32, No. 10, p. 77, 1946; also ref. cited in footnote 17.

Generated on 2024-09-19 22:04 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Camp Bird Mine

The original discovery on what is now the property of the Camp Bird, Ltd. (figs. 2, 4a, and 4b) was made in 1877 in Imogene Basin by prospectors in search of high silver-bearing ore. There is evidence that they were aware of the existence of a certain amount of gold in the ore, but the high cost of packing it to Silverton by mule, together with the high smelter rates, did not permit handling of the $20 per ton rock.20/ During 1896 a small group of men was engaged in development, and Thomas F. Walsh, who was passing by, stopped to examine some quartz on the dump. Assays confirmed his suspicion that the quartz was high-grade gold ore. He quietly acquired title to all claims in the area by direct purchase or by the purchase of tax title and then developed the property into a large and very profitable mining operation. By 1913 the Camp Bird, Ltd., an English corporation, the present owners, had purchased all of the property. This organization had extracted most of the high-grade gold ore by 1916, and the inflow of water made further sinking uneconomical. A subsidiary was then incorporated under the name of the Camp Bird Tunnel, Mining & Transportation Co. to drive a low-level adit (14th level) 11,078 feet in length to intersect the vein 450 feet below the lowest workings. Very little gold ore was discovered by drifting east and west on the vein, and large-scale operations were not resumed.

King Lease, Inc., leased the property in 1925 and have operated it continuously since that time. Officials of the King Lease, Inc., are R. S. Dunn, general manager, Franklin A. Bell, general superintendent, C. N. Bell, Jr., mine superintendent, and Guss Cossairt, mill foreman.

Available records indicate that production from this mine has exceeded $34,000,000.

Description of the deposit. - The Camp Bird vein occupies a fault fissure that crosses the greater portion of the Red Mountain, Sneffels, Telluride area on a general east-west course. In the vicinity of Telluride and its crossing of the Smuggler-Union and Montana veins it is known as the Pandora. The extensive workings of the Camp Bird mine are situated in Imogene Basin, and this portion of the vein is known as the Camp Bird. To the east of Imogene Basin, the vein apparently splits into several components and is dissipated.

In the vicinity of the Smuggler-Union, the vein has a southerly dip of about 65°, whereas in the eastern part of the Camp Bird workings it is somewhat steeper and has a southerly dip of 70°. A vertical displacement of about 120 feet was indicated by Bureau of Mines diamond drilling on the Camp Bird tunnel level to the east of the crosscut.21/ Apparently the hanging wall has moved westward with respect to the footwall, but the amount of horizontal movement has not been definitely determined.

20/ Denver correspondence, The True Story of the Camp Bird Discovery: Eng. & Min. Jour., vol. 89, p. 1266, June 18, 1910.

21/ Young, W. E., and Deshayes, E. V., Camp Bird Lead-Zinc Deposits, Ouray County, Colorado: U. S. Bureau of Mines Report of Investigations 4230.

Generated on 2024-09-19 21:54 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The vein filling is composed of massive quartz and is of variable width, usually 5 to 10 feet. At the Camp Bird mine minerals of commercial grade apparently are in three principal shoots - the Hematite to the east, the Big Discovery to the west, and the Camp Bird in the vicinity of the crosscut (figs. 7a, 7b, and 7c, plan; 8a, 8b, and 8c, vertical projection). Most of the production has been from the Hematite shoot, and current production is from the Big Discovery shoot. Production from the Blue Bird shoot has been principally from the upper levels, or gold-ore zone. The contact of the San Juan tuff with the later pyroxene andesite flows of the Silverton volcanic series represents the approximate upper limit of these ore shoots.

The gold-bearing zone extended through a vertical range of about 500 feet from the third level of the mine upward to the base of the flow rocks. The ore from this zone averaged 1.4 ounces gold and about 2 ounces silver per ton. Below the third level, the gold content decreased until, at the 6th level, it averaged only 0.13 ounce gold per ton. Through the same zone, the silver content increased to 4.5 ounces per ton with about 2.2 percent lead and 2.4 percent zinc. The ore extracted between the 6th and 14th levels has been of about the same average grade.

The ore in the upper, or gold, zone was nearly pure quartz containing gold in the "free" state and a little silver and was successfully treated in the stamp mills of that time. At greater depths the vein maintains its general characteristics, but galena, sphalerite, and some chalcopyrite, together with appreciable amounts of pyrite, appear locally in sufficient quantities to be of economic importance. These minerals are localized in bands within the vein. The most easterly ore shoot contains considerable hematite and was named accordingly.

Development and mining. - The mine has been developed by three principal crosscut adits at successively lower levels (figs. 4a and 4b). The 14th or "tunnel level," at an altitude of 9,822 feet, is about 2,000 feet below the outcrop of the vein. This crosscut intersected the vein 11,078 feet from the portal and now serves as the haulageway by which all ore is transported from the mine to the mill, which, together with the shop, is situated at the portal. Interior incline shafts and ore passes connect the haulageway with upper workings.

The main drift on the "tunnel level" has developed the vein nearly 3,000 feet eastward and 2,000 feet westward from the point of its intersection by the haulageway. The upper levels, especially above the sixth, have explored the vein extensively. All workings maintained for mining operations are of ample proportions, well-timbered and ventilated.

Stoping has been almost entirely by the shrinkage method. During the early operations the stopes were arranged and operated according to the character and grade of the ore being extracted. Such a system does not give the appearance of regularity but is the result of the type of shoot being mined. The stopes are serviced by raises, which are generally equipped with air hoists and slides. A raise may be started at what had been planned as the end of the stope, but after the ore has been extracted the upper portion may be near the center. The stopes are started by back stoping, followed by installation of stulls, lagging, and chutes.

Generated on 2024-09-19 22:02 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

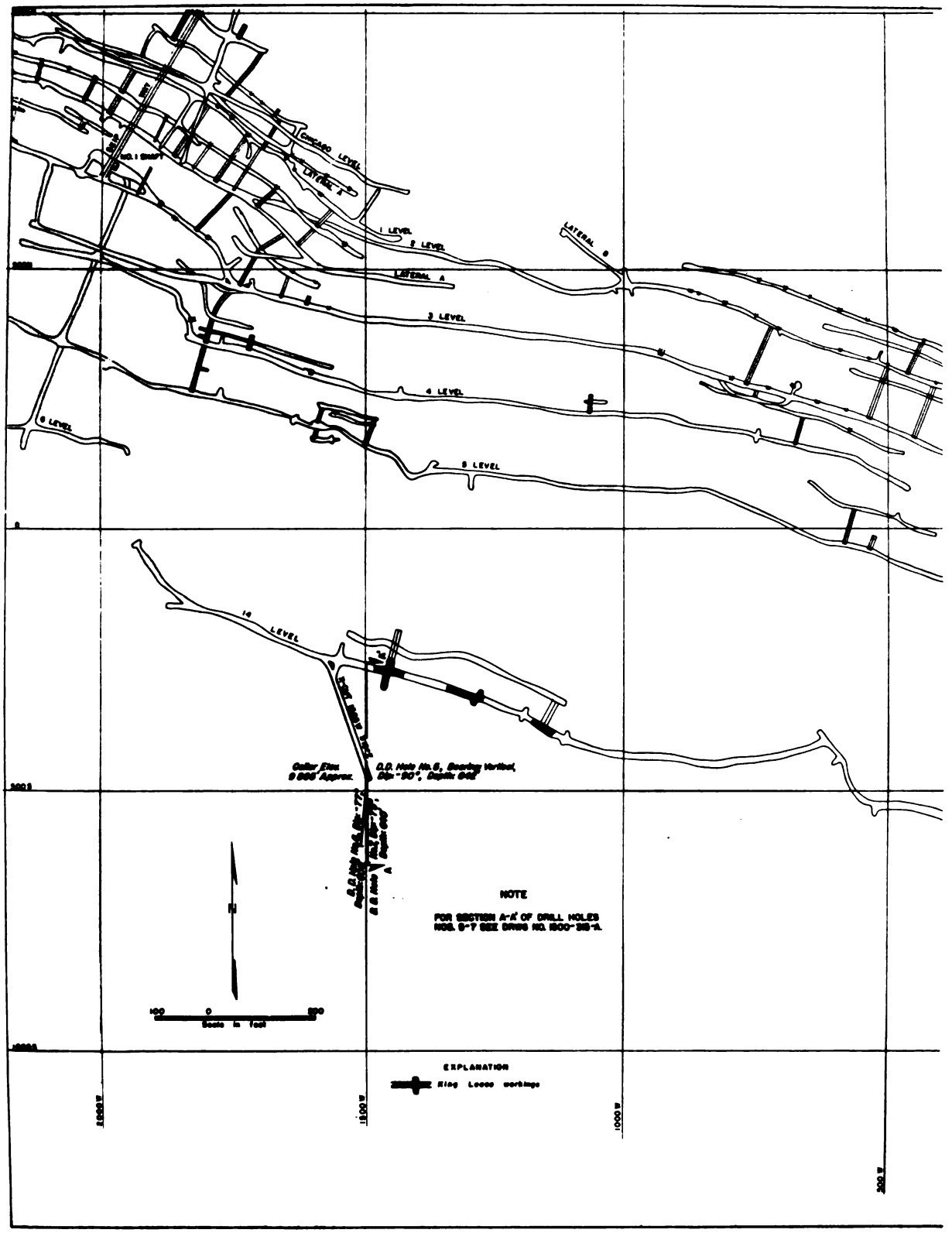

Figure 7a. - Plan of underground workings, Camp Bird mine, Ouray County, Colo.

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

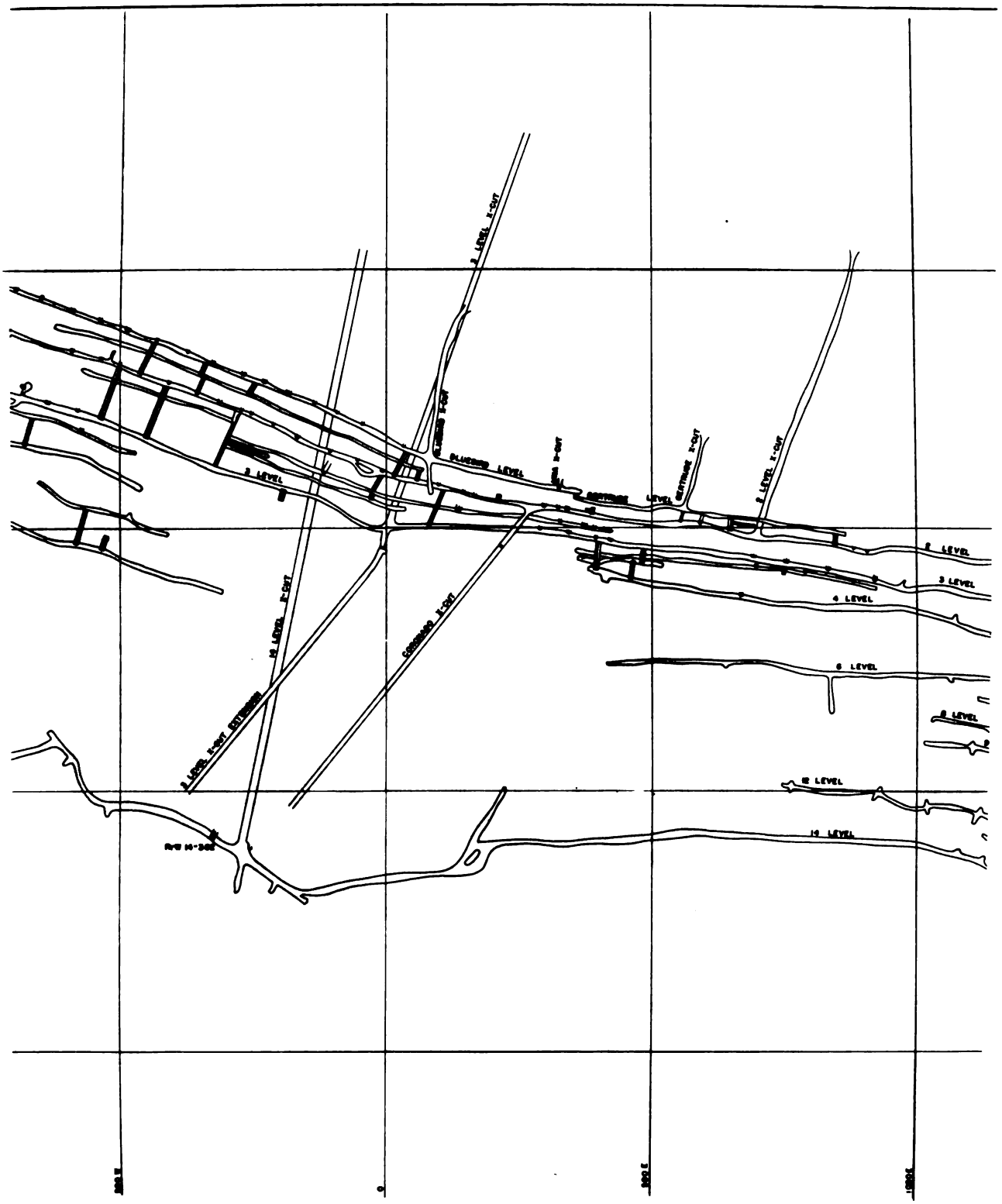

Figure 7b. - Plan of underground workings, Camp Bird mine, Ouray County, Colo.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Figure 7c. - Plan of underground workings, Camp Bird mine, Ouray County, Colo.

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

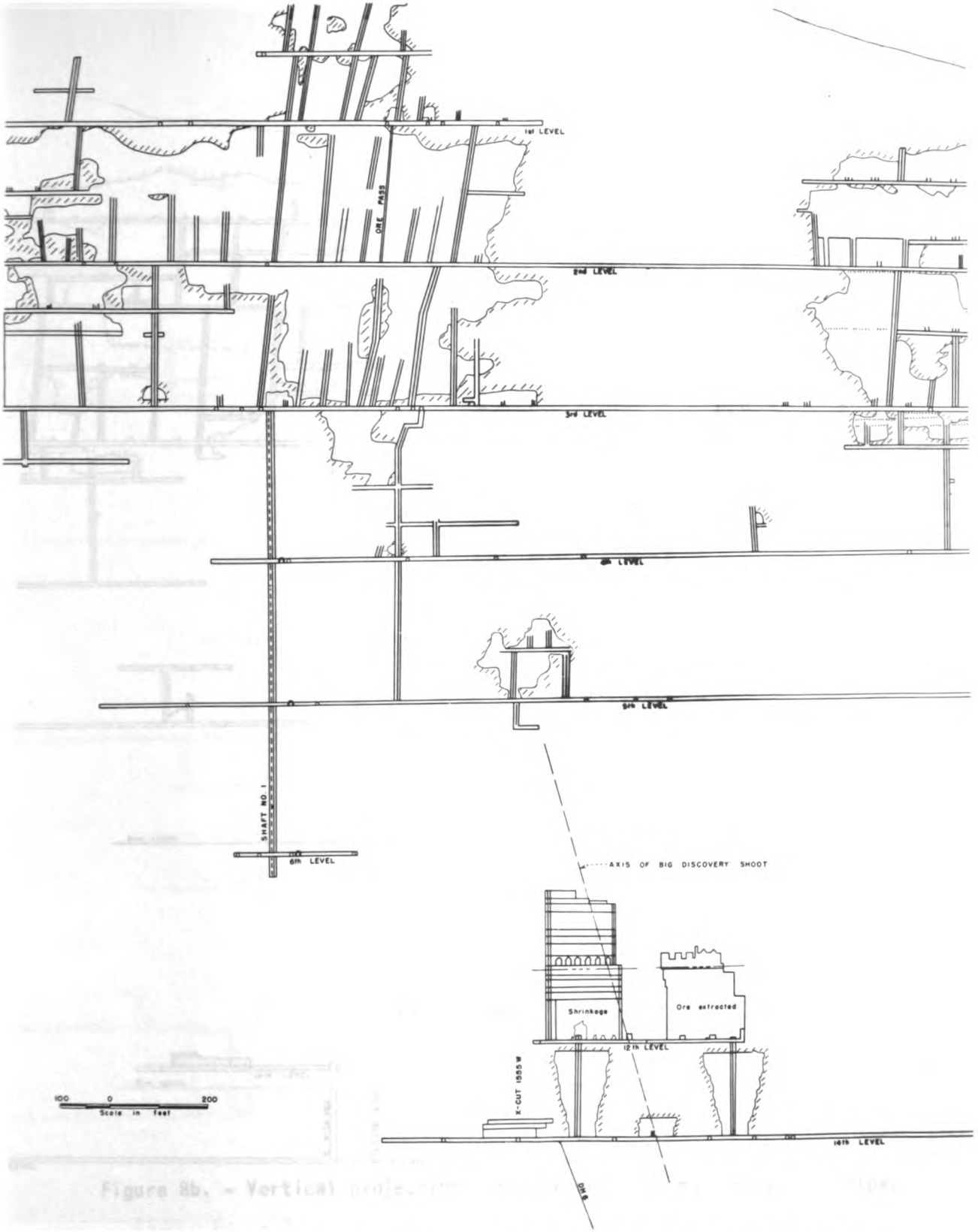

Figure 8a. - Vertical projection, underground workings, Camp Bird mine.

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

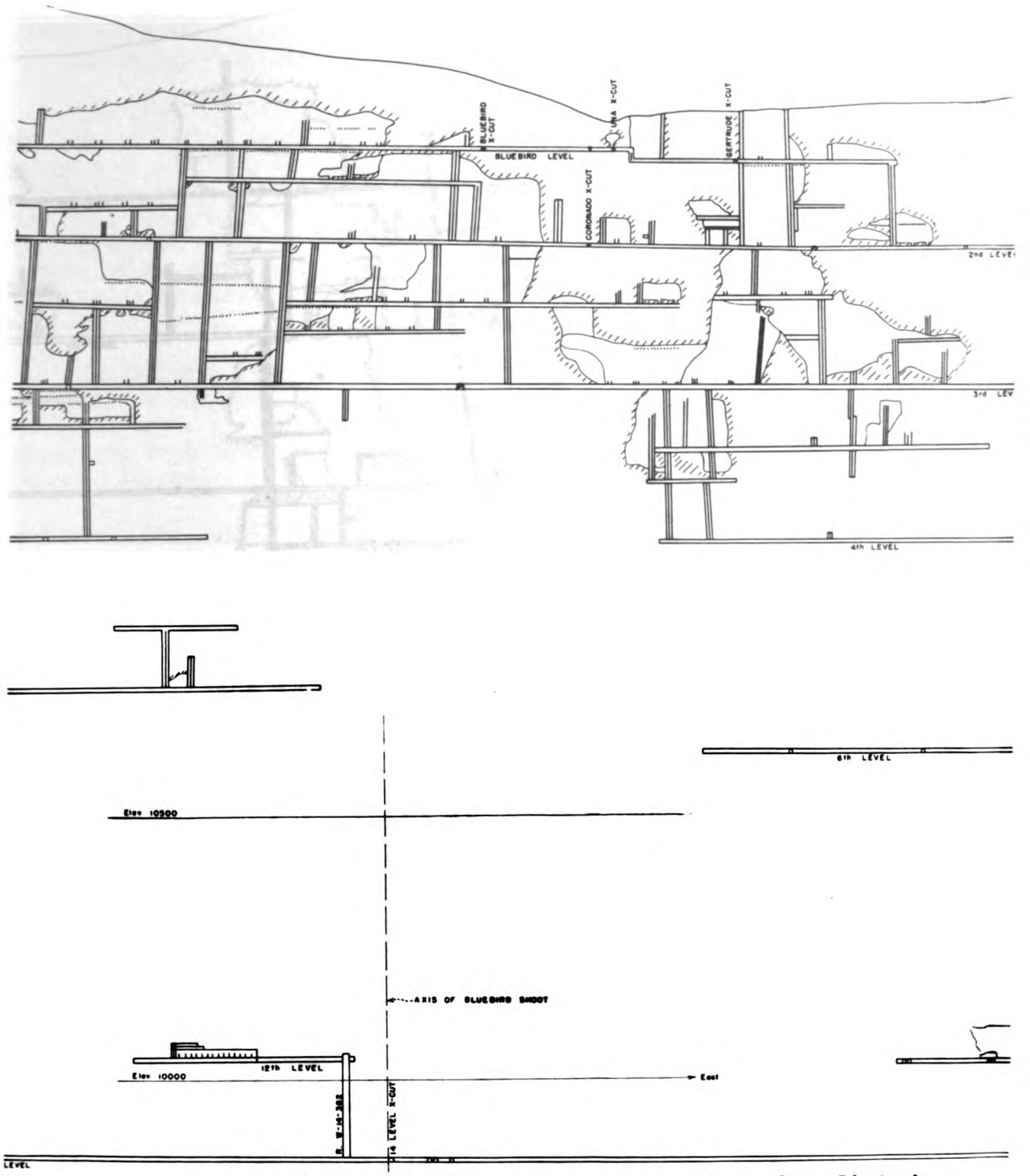

Figure 8b. - Vertical projection, underground workings, Camp Bird mine.

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

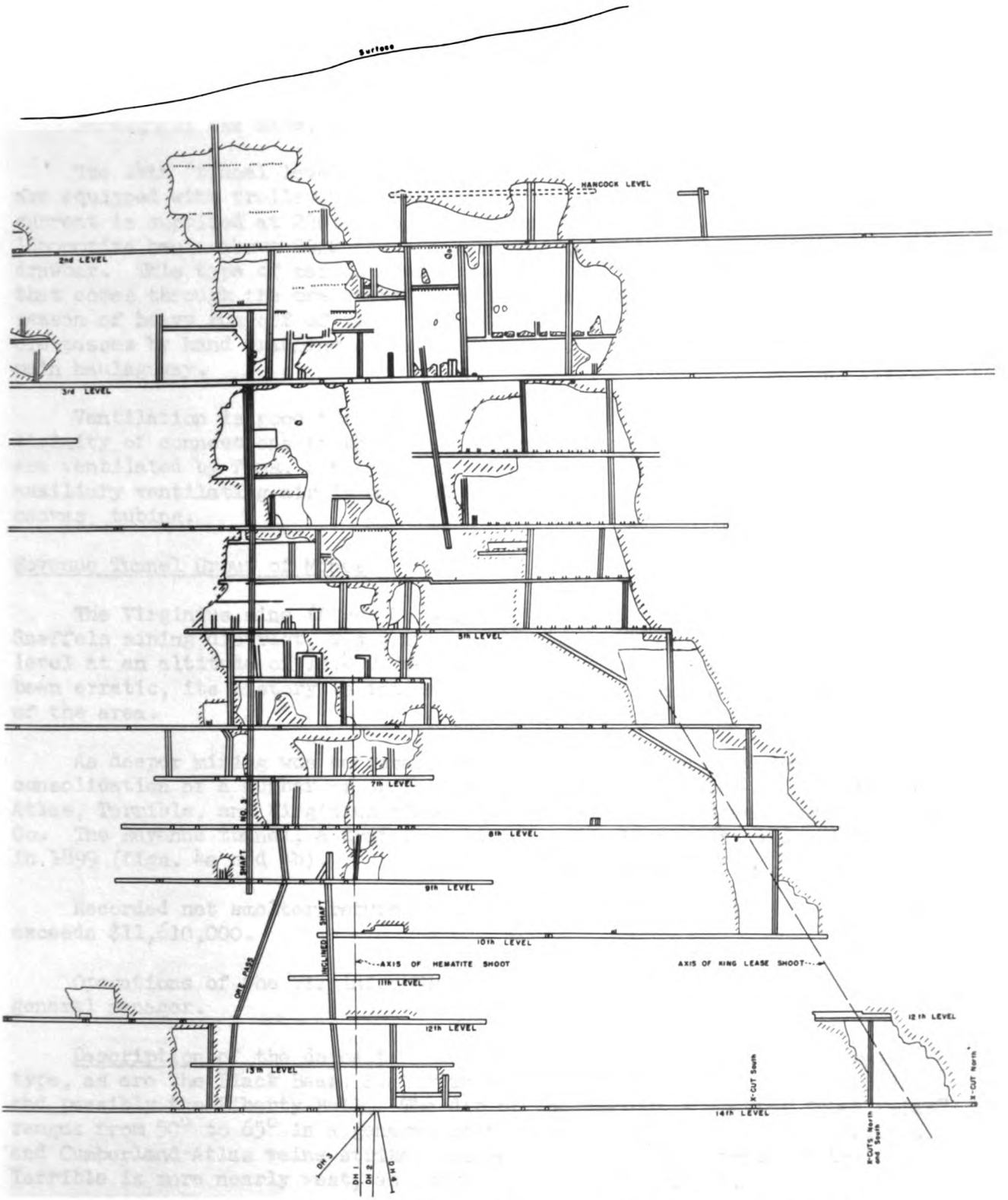

Figure 8c. - Vertical projection, underground workings, Camp Bird mine.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Drilling in the stopes is done by heavy, self-rotating, stoper drills "chucked" for 1-inch quarter-octagon steel. Detachable bits are used and are sharpened at the mine shop. Drilling in drifts is done with the heavy drifting machines generally mounted on twin-screw columns.

Throughout the mine, blasting is done by use of caps and fuse.

The 14th "tunnel level" haulageway and the drifts in each direction are equipped with trolley wire for trolley locomotive haulage. Direct current is supplied at 220 volts by a motor generator set. The 5-ton locomotive hauls about 20, 2-ton, rocker-type, side-dump cars equipped with drawbar. This type of car is used because of the large amount of water that comes through the ore passes with the ore, especially during the season of heavy run-off of melting snow. Ore is moved from stopes to the ore passes by hand tramming on the few currently operating levels above the main haulageway.

Ventilation is good throughout most of the mine, especially in the vicinity of connections to the upper levels. Stopes and dead-end drifts are ventilated by fans, both electric and compressed-air driven. The auxiliary ventilating air is carried through vent pipe of both metal and canvas tubing.

Revenue Tunnel Group of Mines

The Virginius mine (figs. 2, 4a, and 4b), situated in Virginius Basin, Sneffels mining district, was opened in 1877 and worked through the upper level at an altitude of 12,400 feet. Although operation of the mine has been erratic, its history is intimately connected with the early operations of the area.

As deeper mining was necessary, the difficulties encountered encouraged consolidation of a number of operations. The group included the Cumberland-Atlas, Terrible, and Virginius mines and is known as the Revenue Tunnel Mines Co. The Revenue tunnel, a drainage and transportation adit, was completed in 1899 (figs. 4a and 4b).

Recorded net smelter returns indicate that the production of the group exceeds $11,610,000.

Operations of the Virginius Mines Co. are directed by R. S. Dunn, general manager.

Description of the deposit. - The Virginius is one of the "flat-vein" type, as are the Black Bear, Flat vein of the Smuggler-Union, the Humboldt, and possibly the Liberty Bell. The dip of the various so-called "flat veins" ranges from 50° to 65° in a general southwesterly direction. The Virginius and Cumberland-Atlas veins strike northwesterly, but the strike of the Terrible is more nearly west, as shown on figures 4a and 4b.

The vein filling is composed principally of quartz and a quartz-cemented andesite breccia containing appreciable amounts of calcite in some sections.

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Rhodochrosite is one of the prominent gangue minerals of the Cumberland vein. The veins have been further mineralized with galena, sphalerite, pyrite, and a small amount of chalcopyrite. The silver minerals argentiferous tennantite and proustite have formed small bunches of high-grade ore in the Virginius mine. The Terrible and Atlas veins were silver-lead producers, although they are reported to have produced gold also, particularly the Atlas. The present operating company considers the Cumberland and Atlas to be the same vein, although there may be some doubt about this.

It is reported that the ore occupies the central portion of the Cumberland vein and that a gouge about 1 foot in thickness is between it and the hanging wall. It is also reported that a zone 1 to 3 feet in thickness, comprised of crushed quartz and country rock containing a small amount of lead-zinc mineral, lies between the ore and the footwall.

Development and mining. - The Virginius mine was first worked through the "upper tunnel" at an altitude of 12,400 feet in Virginius Basin. The Terrible was operated through adits at various elevations on the vein, whereas the Atlas was developed through a crosscut driven in a southwesterly direction at an altitude of about 11,200 feet.

The Revenue tunnel was started at about 10,600 feet altitude and was driven southwestward to its intersection with the Virginius vein, 7,575 feet from the portal. This intersection is about 2,000 feet vertically below the outcrop.

The tunnel has been abandoned and rehabilitated several times, and it is reported that a fire at the Virginius shaft caused suspension of the operation that preceded the present.

The Virginius vein was further developed by a shaft sunk in country rock to a depth of 750 feet near the intersection of the vein by the Revenue tunnel. Most of the drifting from this shaft had been done to the southeast on the 350-foot level, although drifts about 200 feet in length were driven from both the 210- and 550-foot levels. A drift about 50 feet in length had been driven to the northwest from the 550-foot level. Most of the development of this type was from and above the Revenue tunnel level along the east branch of the Virginius vein.

A drift from the tunnel level was driven southeasterly to the Montana vein of the Telluride Mines, Inc., property. It is about 500 feet above the Pennsylvania level of that company's mine and aids the ventilation of both mines materially. There appears to be some discrepancy in regard to the altitude of this drift, as it is indicated to be 10,750 feet on some maps, whereas on others it is designated as 10,730 feet.

The Terrible vein was developed by the Terrible drift to the northwest and the Sidney drift to the southeast from the Revenue tunnel. The Terrible drift was driven about 200 feet beyond the intersection of the Ansborough and Terrible veins. A raise was driven about 400 feet above the drift at the crossing of the veins.

Generated on 2024-09-19 22:06 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The Cumberland-Atlas vein crosses the Revenue tunnel at a point 4,000 feet from the portal. The old maps indicate considerable stoping and exploratory work, but other information is confusing. It is reported that: "The Murchison raise is 400 feet high above the tunnel level. The ore thins to uncommercial width at 320 feet height in the raise."

It was also reported that the Requa shaft, a winze on the vein, is situated about 600 feet northwest of the Revenue tunnel and was completed subsequent to currently available maps.

The present operating company obtained control of the property and began rehabilitation of surface installations during May 1946. The Revenue tunnel has been placed in operating condition, the station at the Virginius shaft retimbered, and the shaft rehabilitated to the 210-foot level. The drift to the southeast on the 210-foot level has been opened to the face about 200 feet and extended 140 feet. An exploratory raise is in progress from a point near the face of this drift. A drift has also been driven 50 feet northwest of the station on this level.

Rehabilitation of the drift to the southeast on the Cumberland-Atlas vein was started in January 1947. An area of badly caved ground was encountered, and a drift was driven around it. This drift, known as the Atlas Drift, has been advanced 500 feet to the southeast. To the northwest on this vein, the work of rehabilitating the Cumberland Drift was started during March 1947. An exploratory winze was in progress at a point about 140 feet from the Revenue tunnel during December 1947.

The company employed 18 men during the early period of operation, and about half of them were engaged in rebuilding the portal buildings, boarding house, and a few dwellings. With the completion of this surface work, they planned to maintain an operating force of about 12 men, working only the day shift.

Non-Operating Mines

The Hidden Treasure mine has not operated for many years. According to Ransome:22/

> This mine, just north of the Camp Bird, was opened in 1875, but, like other properties in Imogene Basin, has lain idle for many years. It is now owned by Mr. Walsh (see Camp Bird), and will probably be worked again. It has at present about 2,000 feet of drift, and has produced some ore from its stopes. It is opened by a crosscut tunnel about 150 feet in length. The lode strikes about N. 50°W. and dips northeast at approximately 60°. It is a regular lode, in part occupying a sheeted zone and in part a solid vein of quartz and ore. The country rock is San Juan breccia (tuff). There has been some later movement along the plane of the vein, as shown by thin clay gouges. The ore formerly extracted is said to have consisted chiefly of galena

22/ Work cited in footnote 10, p. 204.

Generated on 2024-09-19 22:06 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

and tetrahedrite and to have contained 100 ounces silver and 42 percent of lead. The present workings show a low-grade milling ore consisting of galena, abundant sphalerite, and some chalcopyrite.

There is information, the authenticity of which is not verified, that in 1920 a small gravity concentration mill was built and about 6,000 tons of low-grade ore was mined, but actual records are not available. It is also reported that the U. S. Smelting, Refining & Mining Co. operated the property for a short time during 1926. It is said that the workings were opened during 1936 and sampled by Ira B. Joraleman, mining engineer of San Francisco, Calif., who estimated the partly developed ore in sight to be 10,000 tons with a content of 0.025 ounce gold and 6 ounces silver per ton, 0.29 percent copper, 5.8 percent lead, and 7.1 percent zinc.

The deposit has been explored by crosscut adits, which are not accessible, but the No. 3, or lower adit, at an elevation of 11,428 feet, is reported to be 160 feet in length, which agrees fairly well with the 150 feet given above by Ransome.

According to Ransome:23/

> This (Wheel of Fortune) lode occupies a strong and persistent fissure, with nearly northeast and southwest strike, crossing Canyon Creek just east of the Revenue tunnel ***.
>
> The Wheel of Fortune was located about 1877 and has produced some very rich ore. According to Mr. Krisher, now foreman of the Revenue tunnel, the mine, prior to 1880, shipped some ore to Black Hawk containing 20 ounces of gold and 800 ounces of silver. In 1879 the mine had about 500 feet of drifts and shaft and was said to have produced $20,000. Most of the work was done in the early eighties. During the later 6 months of 1882, the mine shipped about 62 tons of ore averaging 176 ounces of silver and $8 in gold per ton. (Report of the Director of the Mint, 1882.) The ore appears to have been irregular or pockety in its occurrence and is said to have contained freibergite and stephanite, with galena and ruby silver. In 1899 the mine was being reopened after several years of idleness.

According to Ransome:24/

> This property (the Bimetallist mine), situated on Potosi Peak and probably on the same lode as the Wheel of Fortune, has produced from $40,000 to $50,000 from a single pocket near the surface. The ore of this pocket ran usually about 10 ounces of silver and 1 ounce of gold. Chemical examination of a specimen of this ore shows it to be a silver-copper sulphantimonic arsenite (tetrahedrite?), in which gold is probably combined with silver. Small portions, however, were very much richer. The workings were idle in 1899 and were not visited.

23/ Work cited in footnote 10.
24/ Work cited in footnote 10.

Generated on 2024-09-19 22:04 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The position of the vein on which both the Wheel of Fortune and Bimetallist mines are situated, together with the location of the workings, are indicated on the map (plate I, 1941) prepared in connection with vol. 14, No. 5, Colorado Scientific Society Proceedings, by W. S. Burbank of the U. S. Geological Survey. No further factual information regarding either mine, however, has been presented.

Aside from the nonoperating properties mentioned above, Ransome indicates that the Hancock mine to the east of the Camp Bird upper workings was owned by Walsh and is probably a part of the Camp Bird property. The location of the Yellow Rose mine mentioned by Ransome is not indicated by the later work of Burbank, unless the name has been changed by later owners, a practice sometimes followed. The probable location of the U. S. Depository mine, mentioned by Ransome as probably being on the same vein as the Yellow Rose, has been indicated by Burbank. From its position near the line of the Camp Bird 14th level crosscut adit, it is suspected that both the Yellow Rose and U. S. Depository are now a part of the Camp Bird holdings.

Available information indicates that most of the other numerous prospects and properties that have operated intermittently in the area are now in the possession of the Telluride Mines, Inc., Idarado, or Camp Bird companies. Probably the only exception is property on the Japan vein opened by the Mikado and Japan tunnels, which has not operated for many years.

The Japan vein is situated a short distance to the east of the Montana-Argentine vein and strikes about N. 47° W., with a dip to the southwest of about 82°. It does not appear to have affected the Montana-Argentine vein to the northwest, nor does it connect with the Tomboy to the southeast. According to Ransome,25/ the ore is comprised of galena, sphalerite, with a little free gold, argentite, and wire silver. "The principal vein minerals are quartz with some rhodochrosite and a little fluorite." He states that the average value of the Japan ore is about $25 per ton (as of 1901). "Nearly half of this is in gold, the other being equally between silver and lead."

According to Worcester,26/ the Japan or lower tunnel, at the elevation of 10,975 feet in Savage Basin, intersects the Montana-Argentine vein, but is sealed from it by a heavy concrete bulkhead.

Ransome also stated:

> The lode as a rule is an unusually regular plate of ore, having an average width of about 18 inches and generally frozen to the walls. Less frequently it is a regular sheeted zone, 3 or 4 feet wide, the stringers of ore and quartz showing comb and vug structure. Even where the lode is a simple solid vein a foot in width, the walls, especially the footwall, may show conspicuous sheeting for some distance from the ore. The

25/ Work cited in footnote 10, pp. 211-213.
26/ Worcester, H. S., president and general manager, Telluride Mines, Inc., personal communication.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

hanging wall is usually smooth and regular. The country rock of the portions of the vein now worked is andesite breccia of the San Juan series (San Juan tuff).

According to Ransome, the production from the Japan has amounted to about $600,000.

Iron Springs Mining District

The Iron Springs mining district includes the area surrounding Ophir (fig. 2), and is sometimes spoken of as the Ophir district. Ophir is situated about 10 miles south of Telluride on State Highway 145, San Miguel County, Colo. (fig. 3). The old town of Ophir, once a thriving mining camp, is 2 miles east of the present post office up Ophir Valley. The district is served by the narrow-gage Rio Grande Southern Railway, as well as the State highway.

The demonetization of silver was the principal factor that caused the decline of activity, although some of the mines have operated more or less continuously since the early days. Some of the smaller properties have operated during periods of favorable metal markets, such as during wartime.

The area is one of high relief, the altitude being about 9,300 feet, and the walls of the eastward-trending narrow valley rise precipitously, almost cliff like, for upward of 2,000 feet on each side. The high country both to the north and south of the valley is very difficult of access and has discouraged prospecting as well as operation. Despite the high altitude the slopes of the mountains, where not too precipitous, support the growth of timber, underbrush, and grasses to the altitude of timberline. This mantle, together with the heavy winter snowfall and short season, has been an additional hindrance to prospecting and operating.

General Description of the Deposits

The area has been subjected to considerable volcanic activity, Yellow Mountain representing the principal stock in respect to size. This area might possibly be classed as the western exterior portion of the Silverton caldera in much the same manner as the northwest exterior portion with Mt. Sneffels and Stony Mountain at its extremity. In general, the formations are the same as those exposed in the Telluride Valley - that is, the Morrison sedimentaries of Jurassic age overlain by the Telluride conglomerate. The San Juan tuff, productive in the Sneffels-Telluride area, rests upon the conglomerate and is overlain by the rocks of the Silverton volcanic series. The intrusion of the Yellow Mountain and other stocks of lesser importance in the proximity have produced considerable alteration.

In general, the principal vein systems are east-west trending - that is, roughly parallel to the valley and extending through the intrusions without material change.27/

27/ Work cited in footnote 11, p. 425.

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Silver Bell Mines Co.

The property of the Silver Bell Mines Co. is situated on the south side of Ophir Valley (fig. 2), and the surface installations are adjacent to the Rio Grande Southern Railway and Colorado State Highway 145 at Ophir. It is 1,600 feet by road from the railway company's siding and the post office to the portal of the mill tunnel or 14th level of the mine. The property consists of 58 mining claims, together with claims to mill sites and placers. These claims cover the east-west vein system between the Butterfly mine on the west and the Carribeau mine on the east, a distance of about 9,000 feet (fig. 2).

The present organization obtained control of the property during 1945. The company is headed by E. H. Sanders, president, Milwaukee, Wis., Clifford R. Wilfley, consulting engineer, Denver, Colo., and Alvin A. Smith, general superintendent, Ophir, Colo. Currently (1948) about 50 men are employed.

Complete production records are not available, but most of the ore was produced prior to 1909 when a 50-stamp mill was in operation. This mill was constructed in 1902 at the railroad level on Howard Fork of the San Miguel River. The ore was transported to the mill from the sixth level, 800 feet above, by a gravity aerial tramway. Subsequently, the mill tunnel or 14th level of the mine was driven, and connection with the upper levels was completed. The present operators have constructed and placed in operation an up-to-date, 150-ton capacity, flotation concentration plant.

Description of the deposit. - Rocks of the Yellow Mountain intrusive range from diorite to quartz monzonite in composition, although locally classified as diorite. The vein system intersecting the intrusive and forming the deposit under exploitation is composed principally of quartz and various other gangue minerals, including calcite, barite, some fluorite, and siderite. The minerals of commercial importance comprise galena, sphalerite, some chalcopyrite, and gray copper, together with some gold and silver. There were three known main veins in the system designated as the Ida, Butler, and Silver Bell, until recent diamond-drill prospecting indicated the presence of at least two hitherto unknown veins adjacent to present workings. The Ida vein dips steeply south and the Butler steeply north.

A Bureau of Mines report indicates that the mine was examined during 1943 in connection with the possibility of obtaining a tonnage of tungsten ore. The weighted averages of 15 samples taken at that time indicated a grade of 1.69 percent WO_3, 0.4 percent zinc, 0.05 percent lead, 0.03 percent copper, no gold, and 1.75 ounces silver per ton. The operators report that some wolframite is recovered in current milling operations.

Development and mining. - During the early days of operation, the mine was developed by a crosscut adit driven southward and by drifts driven to the east and west on the Butler, Ida, and Silver Bell veins. The portal of this adit, known as the 6th level crosscut, is at an altitude of 10,100 feet.

Generated on 2024-09-19 22:04 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

A considerable amount of stoping was done from the 6th level upward. The ore was transported from the portal of the crosscut to the mill by a gravity aerial tramway. These old workings, reported to be about 10,000 feet, have caved and are inaccessible for the greater part. The 3d level of the Butterfly mine was extended on the Ida vein through property now held by the Silver Bell company. The exact location of this drift is not known, but its approximate position is shown in figure 9.

The present operations are carried out through the 14th or mill level tunnel, a crosscut adit driven in a southeasterly direction for some distance beyond its intersection with both the Ida and Butler veins. The portal of this adit is favorably situated adjacent to the highway in an area safe from snowslides at an altitude of 9,300 feet. There is adequate space for all surface installations that may be desired. Drifts have been driven to the east and west on both the Butler and Ida veins. The west drift on the Butler vein is reported to be in ore for over 1,000 feet, and stope preparations are in progress. The strong walls and steep dip are well-suited to the shrinkage method of mining. The preparatory work consists of first backstoping, followed by installation of drift sets, lagging, and chutes. The chutes are spaced on 25-foot centers, with service and ventilation raises spaced at about 100-foot centers. Chutes are installed on both sides of the raises, which are generally of three-compartment size.

Previous operators connected the drift on the Ida vein with the 6th level by an inclined raise, which has not yet been rehabilitated. Additional development is in progress on this vein.

During the past season, the company instituted a geophysical survey program, which was not completed because of the severe winter. The underground survey was considered worthwhile in the extremities of the drifts where there was no interference by rails and pipes. The operators report that core drilling has further indicated the presence of one sulfide body suggested by the survey. The two veins recently found by core drilling will be explored further by crosscutting and drifting.

The mine is well-equipped, and compressed air is furnished by three compressors with a combined capacity of 1,265 cubic feet per minute, transmitted to the working places by a 6-inch air line. Ventilation is aided by a blower-exhauster fan powered by a 35-horsepower motor. Tramming is done by a 1-1/2-ton Atlas storage-battery locomotive that hauls 16 to 20 cubic foot capacity cars over 30-pound rails set at 18-inch gage.

The muck from drifting and backstoping is loaded into mine cars with a mucking machine.

San Bernardo Mine

The San Bernardo mine (fig. 2) is situated about 3 miles south of Ophir on Colorado State Highway 145, San Miguel County, Colo. The camp and mill are on the Rio Grande Southern Railway as well as the State highway. The railroad siding that serves the camp was known as San Bernardo in the early days of the district, but the name was later changed to Matterhorn.

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

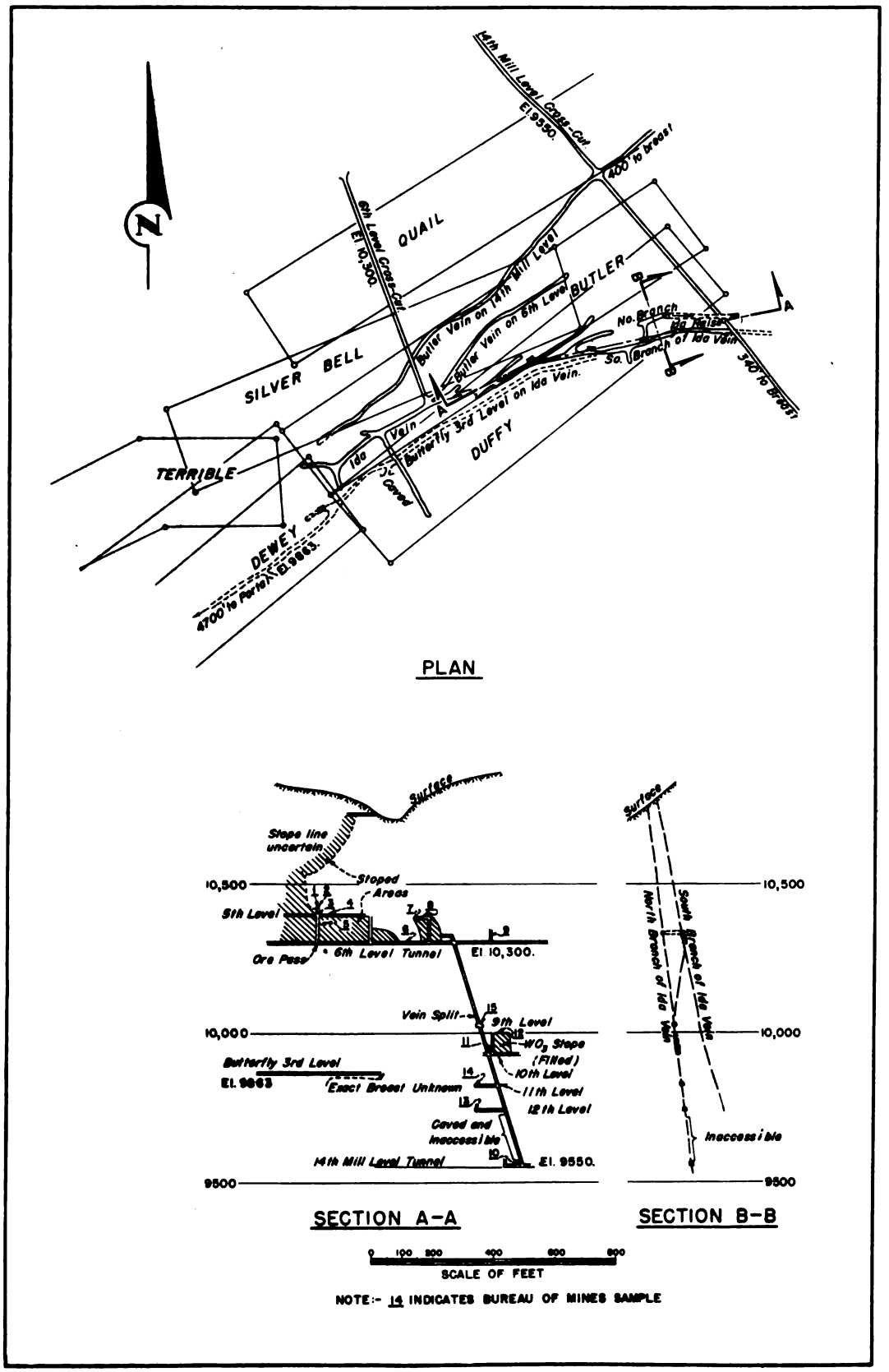

Figure 9. - Plan and sections of workings on Ida Vein, 6th level to 14th level, and Butterfly 3rd level, Silver Bell mine.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The claims were located in the early 1880's, and the property has been operated intermittently since that time. The Paragon Mines, Inc., owns the property. Otto Beselack, Ophir, Colo., is general manager of the organization, which is now engaged in rehabilitating the mine.

The previous Otto Mining Co. operations were suspending during 1928 after most of the present equipment had been installed. It is reported by Beselack that lead-silver concentrates produced by this organization had a gross value of $1,000,000, and that total production has been $4,000,000. It is also reported that the last 72 carloads of concentrates, averaging 20.6 tons each, contained about 38 percent lead, 6 to 9 percent zinc, 4.89 percent copper, 228 ounces silver, and 0.063 ounce gold per ton. The concentration ratio is reported to have been about 14 to 1; however, recovery was poor.

Description of the deposit and mine. - The mine is situated across the narrow valley from the mill and railroad siding and is connected with it by an aerial tram about 1,800 feet in length. The deposit, which has been exploited, is comprised of a westerly trending vein exposed on the eastern slope of the precipitous side of the valley. This vein intersects the Cretaceous shales and limestones, which are nearly horizontal in position in the area and rest unconformably on the pre-Cambrian schists, slates, and quartzites. The vein dips to the north at about 65° and ranges in width from 1-1/2 to 8 feet. A diorite-monzonite, which has been intruded into the sedimentaries, does not appear to have had any material effect upon mineralization or physical character of the vein.

The principal ore minerals are galena, sphalerite, chalcopyrite, gray copper, native silver, and ruby silver in a gangue of quartz, with rhodochrosite and some siderite.

The last 230 feet of drifting on the No. 5 level assayed 0.03 ounce gold and 11.35 ounces silver per ton, 5.35 percent lead, and 0.42 percent copper, and the last 50 feet averaged 0.03 ounce gold and 20.75 ounces silver per ton, 10.82 percent lead, and 0.83 percent copper, according to Beselack. Zinc was not determined.

The vein has been developed by five drift adits. The No. 5 tunnel, at an altitude of about 9,800 feet, is now the principal working level and is connected with the mill by the aerial tram. This level is reported to be 3,100 feet in length, and its rehabilitation is the object of the present operations. During the latter part of November 1947, this work had been completed to a point about 1,500 feet from the portal.

The vein has been further developed by raises and sublevels, and a considerable amount of stoping has been completed. The shrinkage-stoping method of mining has been employed, but some dilution has been experienced in extraction of the vein within the shale strata.

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Silver Pick Mine

The Silver Pick mine is on Mount Wilson at the extreme western side of the Telluride Quadrangle in San Miguel County, very near the boundary line between San Miguel and Dolores Counties. The location of the mine is indicated on a U. S. Geological Survey map prepared by the Hayden Survey in 1894. It is also mentioned by Purington in his section covering the Economic Geology of the Quadrangle.28/

The propery, comprising some 14 or 15 claims and a millsite, is now owned by Everett Blackburn, Placerville, Colo., who made available information in connection with it. He also gave the specific location as sec. 32, T. 42 N., R. 10 W., N.M.P.M. According to his records, production during 1882, 1885, and 1889 to 1898, amounted to 6,050.063 tons of ore, and the net returns were $601,185.30.

Description of the deposit. - The deposit that has received attention at this property is a gold-bearing quartz vein of rather narrow width, a nearly vertical inclination, and striking N. 40° E. The country rock in this area is composed of the diorite or diorite-monzonite of the Mt. Wilson stock.

The following sampling record has been excerpted from a report in Blackburn's possession prepared by a private engineer.

Sample level	Estimate of tonnage	Width of vein, inches	Value per ton
1	455	3.0	$30.32
2	463	4.7	54.64
2	-	-	59.64
3a	666	4.7	27.54
3c	3,076	3.5	27.79
4	679	4.0	?
6	80	-	?
7a	1,383	4.7	27.84
7c	2,263	3.5	27.79

Development and mining. - The deposit has been developed by crosscut adits driven at various elevations, followed by drifting along the vein. Since the operations were conducted by various parties, no definite plan was followed, and the seven adits were not numbered or driven consecutively in regard to the altitude of their portals. The adits range in length from 320 feet at No. 2 to over 1,000 feet at Nos. 4 and 5. Adit No. 8 is reported to have a length of 1,800 feet and has not intersected the vein.

The present owner spent the 1947 season in opening the adits, and he stated that, finances permitting, operations would be resumed during the 1948 season. The working season is very short, generally beginning about

28/ Work cited in footnote 10, p. 15.

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

the first part of July and ending early in October, depending on seasonal conditions. It is possible that no work will be attempted during the 1948 season.

Red Mountain District

The Red Mountain district (fig. 2) is principally in the southern part of Ouray County but extends into the northern part of San Juan County. In general, it includes the valley of Red Mountain Creek, across Red Mountain Pass, and into the drainage of Mineral Creek. The slope to the west of the valley includes the principal portion of the ring fault zone. The Red Mountains and Red Mountain ridge to the east of the valley and most of the drainage into Cement Creek on the east side are included in the district. Mt. Abrams forms the northern part of the district.

The area is traversed by U. S. Highway 550 between Ouray and Silverton, the route closely following the Uncompahgre River to its confluence with Red Mountain Creek and along that stream to Red Mountain Pass, and then by way of the valley of Mineral Creek to Silverton. The area is one of high relief, ranging from 9,600 feet in Ironton Park to above 13,000 feet altitude on the mountain peaks.

According to Henderson,29/ the principal production from this section has been from the Yankee Girl, National Belle, Genessee Vanderbilt, Guston, Congress, and several other operations on chimney deposits of lesser importance.

Current production is from the operations of the American Zinc, Lead & Smelting Co. at the Koehler, situated at the top of Red Mountain Pass, and the Lark mine of the U. S. Oil & Development Corp. The American Smelting & Refining Co. is (1948) prospecting through the Genessee tunnel.

General Description of Deposits

The volcanic breccia pipes and the chimney-type deposits of the area have been given a great deal of attention by geologists of the U. S. Geological Survey as well as by representatives of private organizations. Burbank30/ has devoted a considerable portion of his work on ore deposition in the Red Mountain, Sneffels, and Telluride districts to the volcanic breccia pipes and chimney deposits of the district. Some of these pipes are simple, whereas others, such as the Koehler, are compound and very complex. Records afford information that some deposits of extremely rich copper-silver ores have been mined from the cores of these chimneys or pipes, and there has also been an appreciable production from vein deposits within the district.

American Zinc, Lead & Smelting Co.

The American Zinc, Lead & Smelting Co. is now operating the Banner American Mill, also known as the Franz Mill or American No. 1 Custom Mill,

29/ Work cited in footnote 6, p. 184.
30/ Work cited in footnote 10, pp. 170-209.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

2 miles north of Ouray, and has obtained control of some of the mines in the area. The main office of the company is at 1500 Paul Brown Building, St. Louis, Mo., and local operations are in charge of R. E. Calhoun, assisted by M. L. Kay, general superintendent, K. G. Link, mine superintendent, Wm. Klein, mill superintendent, and D. C. McLean, metallurgist.

In the Red Mountain district, the San Antonio mine (fig. 2) is being operated by this company. This mine, together with the Congress and St. Paul workings, is on the Koehler compound breccia pipe. Locally, the mines and property are more commonly referred to as the Koehler. The property is situated at the top of Red Mountain Pass, near U. S. Highway 550, on or near the boundary line between Ouray and San Juan Counties, about 14 miles south of Ouray, mostly in sections 13 and 24, T. 42 N., R. 8 W.

The property was originally located in 1878 and was operated chiefly for the silver content of the ore until silver was demonetized in 1893. The mine was again operated during the period 1907 to 1910 and 1937. The Denver Engineering Co. obtained the property in 1942 and began its rehabilitation.

Description of the deposit. - In the San Antonio mine, as well as other chimney or pipelike deposits of the district, the ore body is elliptical in outline and in a nearly vertical position dipping slightly northwest. This deposit probably has been formed at the intersection of two fracture zones locally referred to as "breaks." The sulfarsenate of copper, enargite, is the principal ore mineral, associated with pyrite and lesser amounts of galena and sphalerite. The outer fringe of the ore body is heavily mineralized with pyrite, which extends well into the country rock. An appreciable amount of talc is included with the sulfides that form the deposit. These chimneys or pipes range from 30 to 150 feet in length and 10 to 60 feet in width. At the location of current operations, the San Antonio deposit is about 60 feet in length and about 20 feet in width.

The production records are far from complete, but 7,777 tons of ore received by the Durango plant of the American Smelting & Refining Co. from the San Antonio mine during the years 1907 to 1910 contained an average of 0.1 ounce gold and 7.73 ounces silver per ton, 10.54 percent copper, 6.19 percent lead, and 2.95 percent zinc. The average assay of 19 carloads shipped to the U. S. Smelting, Refining & Mining Co., Midvale, Utah, during the years 1926, 1927, and 1937, indicated a metal content of 0.125 ounce gold and 8.45 ounces silver per ton, 7.25 percent copper, 11.25 percent lead, and 6.8 percent zinc.

During the years 1912 through 1918, 7,184 tons of ore was shipped to the Durango plant of the American Smelting & Refining Co. from the adjacent Congress mine. The average assay of this ore indicated a grade of 0.313 ounce gold and 5.75 ounces silver per ton, 8.58 percent copper, 4.44 percent lead, and 5.75 percent zinc. Attention is directed to the fact that during these periods zinc was a penalty metal and all possible sphalerite was left unmined, even at the loss of an appreciable amount of galena.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 22:02 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

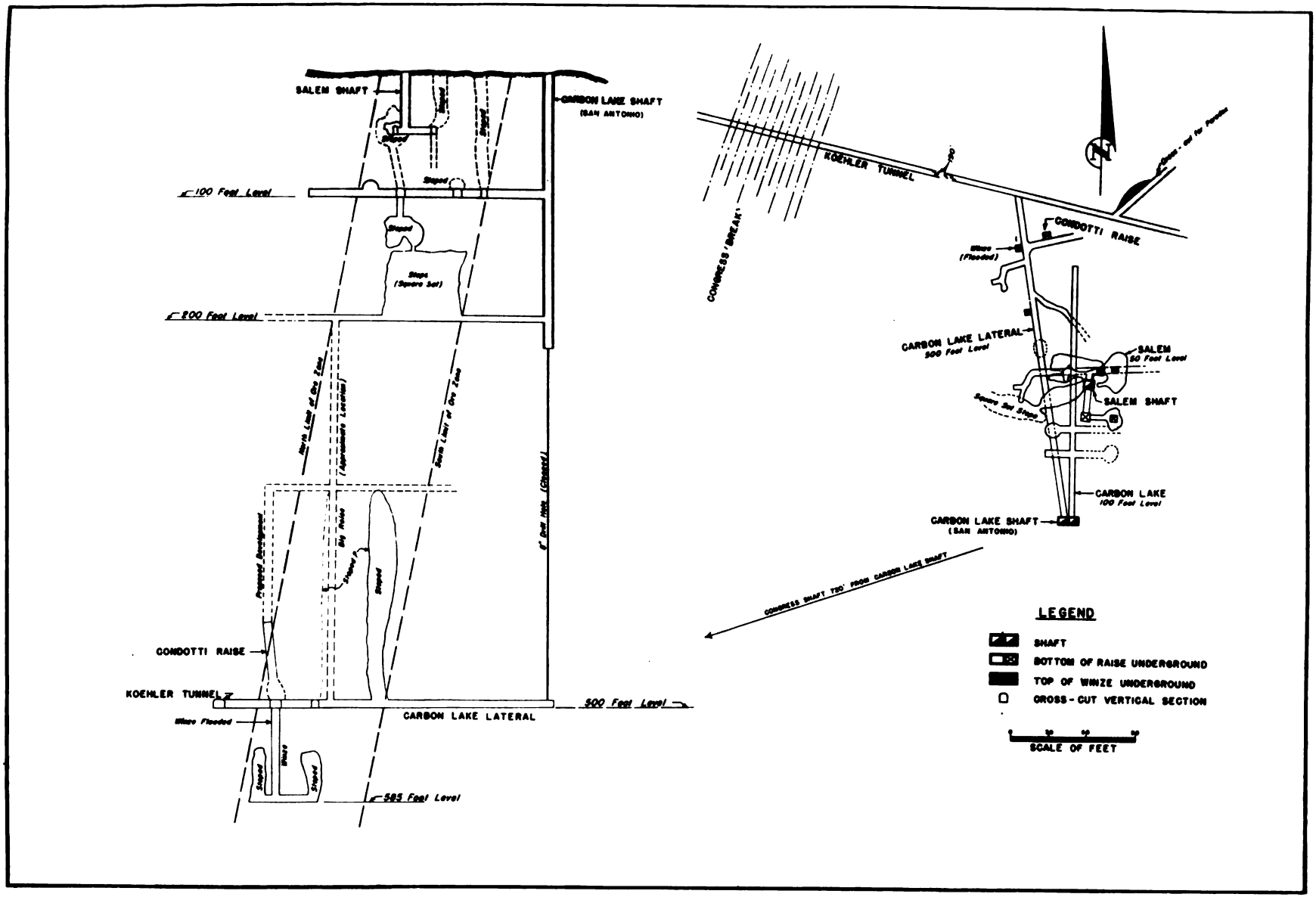

Figure 10. - Plan and section of underground workings of San Antonio mine.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Development and mining. - The Salem and Carbon Lake shafts, 50 feet and 200 feet in depth, respectively, have developed the upper portions of the deposit. The Salem shaft was sunk in the ore body, whereas the Carbon Lake is in the country rock, as shown in figure 10. This illustration also indicates that a portion of the ore body, probably that part having the high silver content, has been stoped from the 200-foot level to the surface.

The Koehler tunnel, started during 1908, develops the San Antonio deposit on the 500-foot level by the Carbon Lake lateral. In order to ventilate the level, an 8-inch hole was drilled from the bottom of the Carbon Lake shaft to the Carbon Lake lateral, but it has caved and become clogged.

The tunnel was driven on a nearly east course a distance of about 2,000 feet and was intended to develop the Camp Robber property farther north, but was not completed. It could be extended under the St. Paul and Congress workings, each of which is credited with considerable past production.

The Carbon Lake lateral passes through the San Antonio ore zone and corresponds to the 500-foot level of the mine. Crosscuts, raises, stopes, and a winze reported to be 85 feet in depth have been driven from this level (fig. 10). A raise has been rehabilitated and extended to a point about 160 feet above the Koehler tunnel level (fig. 10). The raise is equipped with a slide and an air-operated hoist for servicing operations on the level, which crosses the ore body about 147 feet above the tunnel. A raise was driven from this level, a stope was opened, and chutes were installed. Stoping had been extended about 40 feet above this level and had been operating satisfactorily by the shrinkage system. It was considered to be still in the experimental stage during November 1947, and the character of the deposit, as development proceeds, will determine the success of the method.

Drilling in the stope is done by two heavy, self-rotating, stoper drills equipped with 1-inch steel and detachable bits. Test holes are drilled into the walls of the stope at sufficiently close intervals so that any ore within the immediate proximity is not passed without investigation.

The powder used in blasting is detonated with caps and fuse.

The company plans to diamond-drill the extension of the known chimneys during the coming spring or summer.

Ore from the stope is drawn through chutes on the intermediate level, 145 feet above the Koehler tunnel, into ordinary end-dump mine cars and hand-trammed the short distance to the transfer raise. The production averages about 40 tons per day and represents the swell from the shrinkage stope.

The Koehler tunnel level is equipped with 24-inch-gage track and battery-locomotive transportation. Outside of the portal, the track and ore bins are protected by snowsheds with connections to the shop, compressor, and change rooms.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The compressed air used for operating mining equipment, including mucking machines, is furnished by a 2-stage, 400-cubic-foot compressor driven by a 75-horsepower electric motor. Mucking machines are used on the tunnel level only.

The ore is transported from the mine to the mill at Ouray by a local trucking company, which also hauls the supplies from the railhead at Ouray to the mine.

Lark Mine

The Lark mine, also known as Lark lease, is situated on the southeastern flank of Red Mountain No. 3 on the north side of Prospect Gulch, Cement Creek drainage of the Red Mountain district (fig. 2). More specifically, it is in sec. 18, T. 42 N., R. 7 W., although some of the claims are in adjoining secs. 17 and 19 and possibly 20. The mine is operated by the Lark lease of U. S. Oil & Development Corp., V. H. Steele, president and general manager, C. H. Peterson, secretary, and W. R. Green, treasurer. Ross D. McCausland, Jr., is superintendent of operations.31/

The early operators mined the oxidized ore for its silver content, and the property had been idle for a considerable time prior to 1942, when the present organization acquired control.

Description of the deposit. - The chimney or pipelike deposits on the western flank of Red Mountain No. 3 were exploited by the Guston, Yankee Girl, National Belle, Genesee, and other mines. Production from the Lark mine has been from a deposit similar in character, in that it has been considered to be a pipe or chimney. The deposit from which the greater portion of this production was obtained appears to be of the replacement type and apparently has been formed at the intersection of east-west, north-south faults, or fractures in the andesitic rocks of the Silverton volcanic series. The portion of this deposit now mined has been very regular, averaging about 40 feet in length and about 12 feet in width. The early operations exploited the oxidized portion of the pipelike deposit, and during that time No. 2 adit intersected the sulfide or primary portion of the deposit. This portion of the ore body was not mined during that period because it was somewhat lower in lead and silver content and contained sufficient zinc to subject it to a penalty for treatment. The pipes or chimneys do not appear to have the siliceous envelopes, as do those on the western flank of Red Mountain described by Burbank.32/

Some of the ore was shipped by rail direct to the treatment plants in the Salt Lake Valley, but the current production is being delivered to the custom mill of the Shenandoah-Dives Mining Co. near Silverton. A lot of about 100 tons of ore recently delivered to the mill was settled for on the basis of 0.0375 ounce gold and 17.15 ounces silver per ton, 12.3 percent lead, 1.1 percent copper, 6.25 percent zinc, and 10.4 percent iron.

31/ The Nineteen Forty-Eight Mining Year Book, published by The Colorado Mining Association, State Office Building, Denver, Colorado, p. 112.
32/ Work cited in footnote 10, pp. 170-209.

Generated on 2024-09-19 21:55 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

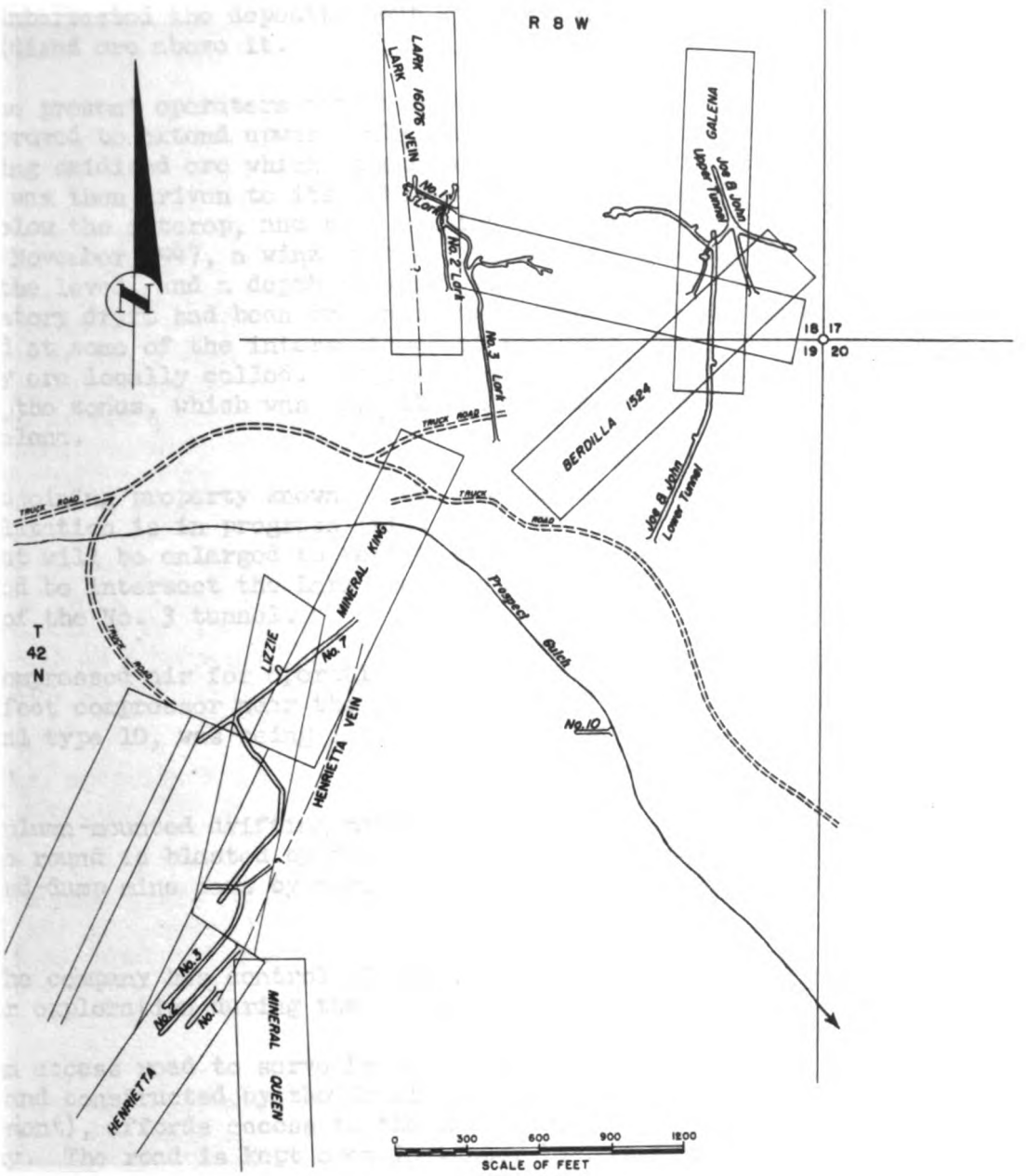

Figure 11. - Claim map and workings of Lark mine.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Development and mining. - The ore body was first explored by a shaft and later an adit designated as No. 1, which intersected it about 135 feet below the outcrop (fig. 11). The early operators also drove tunnel No. 2, which intersected the deposit about 255 feet below the outcrop and extracted the oxidized ore above it.

The present operators extracted the sulfide ore above No. 2 tunnel, which proved to extend upward only about 35 feet. They also mined the remaining oxidized ore which amounted to only a few hundred tons. No. 3 tunnel was then driven to its intersection with the ore body about 480 feet below the outcrop, and that portion above level has been extracted. During November 1947, a winze was in progress to develop the ore body below the level, and a depth of about 70 feet had been attained. An exploratory drift had been driven along a shear zone, and minerals were exposed at some of the intersections of the zone by faults or "breaks," as they are locally called. Exploration by a raise had been started along one of the zones, which was pipelike in character and heavily impregnated with galena.

Adjoining property known as the Joe and John has been acquired, and rehabilitation is in progress (fig. 11). The westward-trending drift or crosscut will be enlarged to permit use of mucking machines and then extended to intersect the Lark ore body approximately 150 feet below the level of the No. 3 tunnel.

Compressed air for operating mining equipment is furnished by a 315-cubic foot compressor near the portal of No. 3 tunnel. A second compressor, Imperial type 10, was being installed at the portal of the Joe and John tunnel.

Column-mounted drifting machines are used to drill the drift rounds, and the round is blasted by fuse and caps. The broken material is loaded into end-dump mine cars by a mucking machine and trammed to the surface by mules.

The company has control of several other prospects and has plans for further exploration during the coming season.

An access road to serve Prospect Basin, approved by the Bureau of Mines and constructed by the Grazing Service (later the Bureau of Land Management), affords access to the Lark mine and is maintained by the company. The road is kept open in winter by means of a bulldozer, even though the area is one of heavy snowfall.

The company contracts with a local trucking concern for the hauling of ore from the mine to the Shenandoah-Dives mill at the rate of $2.50 per ton.

Beaver and Belfast

The Beaver and Belfast property is about 1,500 feet west of U. S. Highway 550 at the old townsite of Ironton (fig. 2), about 2 miles north of the Treasury tunnel portal site within the Red Mountain district.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The property is owned by the Hinkle Investment Co. of Pueblo, Colo., and Roy Van Houten, of Ouray, now has a lease on the property with an option to purchase it. The first work on the property was done during the 1890's at what is known as the Old Beaver Belfast, a short distance to the south and somewhat lower in elevation. Van Houten and associates began work of rehabilitation during January 1947.

Description of the deposit. - The vein under exploration at this property has a general northwest-southeast strike and dips about 82° to the west. It is comprised principally of quartz and quartz-cemented breccia and has produced ore from shoots that rake about 45° within the vein. The shoots or ore bodies have a general lenticular outline and contain lead, zinc, copper, and silver minerals, together with a small amount of gold. Van Houten 33/ reported that by the middle of December 1947 approximately 800 tons of ore had been shipped to the American Zinc, Lead & Smelting Co. custom mill at Ouray and about 100 tons to a smelter at Midvale, Utah. The approximate average assay of this ore was 8 percent lead, 9.5 percent zinc, 2 percent copper, 4 ounces silver, and 0.004 ounce gold per ton. An appreciable amount of the copper is in the soluble form and has given some difficulty in the mill, especially when mixed with other ores.

Development and mining. - The deposit is developed by a 220-foot crosscut driven nearly westerly to its intersection with the vein. From this point a drift has been driven northwestward along the vein for a distance of about 400 feet. The present operation has opened new ground to the northwest and cut out room for chutes at four points. They plan to expand the stoping facilities as rapidly as possible during 1948.

A Diesel-powered, portable, 315-cubic foot capacity compressor was installed when operations were started, and the necessary drifting and stoping machines were obtained as needed.

The ore is transported from the mine to the American Zinc, Lead & Smelting Co's. custom mill at Ouray by a local trucking company at the rate of $2 per ton. The operation is carried out on a split-check basis; the exact terms are of a confidential nature.

Genessee-Vanderbilt

The early operations at the Genessee-Vanderbilt were separate and considered as two mines. According to Ransome, 34/ development and mining indicated that both mines were obtaining their ore from the same source, "or at least so closely associated that it was impracticable to work them separately, and the mines were therefore consolidated." Ransome also reports that operations had been suspended and that the shaft was filled with water at the time of his visit to the district in 1899.

Since that time, sporadic leasing operations on a small scale have been attempted, and some of the drifts on the adit levels were extended

33/ Personal communication.
34/ Work cited in footnote 10, p. 227.

Generated on 2024-09-19 22:02 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

in search of ore bodies. Subsequent work by personnel of the U. S. Geological Survey has been compiled by Burbank.35/ Extensive mapping and study by engineers in the employ of the American Smelting & Refining Co. prompted the exploratory work in progress during 1947-48.

Description of the deposit. - The fact that operations had been suspended prior to any appreciable amount of investigation by engineers in public service makes it necessary that most of the information be obtained from records. These records, as assembled by Ransome of the U. S. Geological Survey, and a short description of conditions by J. E. Schwarz,36/ indicate that the deposit was of the chimney or pipelike type. They suggest that the deposit had been formed along fracture planes or "ore breaks," which afforded a passageway for solutions or vapors emanating from the intrusive or source of volcanic activity. The latite country rock has been silicified almost beyond recognition at some points and has been subjected to kaolinization at others.

According to these reports, the ore near the surface was oxidized and soft, as might have been expected. The ore changed to the sulfides, galena and pyrite, at a depth of about 100 feet. There were also smaller amounts of complex silver-bearing minerals, and, according to Ransome:37/

> The output of the Genesse-Vanderbilt Co. from 1891 to 1896 amounted to about 12,622 tons of ore containing 2,884 ounces of gold, 436,675 ounces of silver, 702,183 pounds of lead, and 30,520 pounds of copper.

The ore body did not maintain the same inclination throughout its length but was offset somewhat by faulting. From the descriptions of conditions, it seems possible that the mineralizers may have followed one set of "ore breaks" to an intersection with another favorable set of fractures. Quoting Ransome further:

> The value of the ore, never high-grade as a whole, fell off with increase of depth below the 300 level, depreciating rapidly below the 500 level, and changing near the 700 level to large bodies of low-grade pyrite.

Information available indicates that this condition has occurred at other similar deposits in this district.

The mine water encountered by the workings was highly acidic and very corrosive. The present operators, American Smelting & Refining Co., report that the same condition still exists, and that the mine water has a pH of 2. It is necessary to protect all pipe and steel equipment as much as possible. The company has hauled nonacidic surface water into the mine for use in the pneumatic drills as well as the contract-operated diamond core drill.

35/ Work cited in footnote 10.
36/ Schwarz, T. E., Trans., A.I.M.E., vol. 26, 1896, p. 1058.
37/ Work cited in footnote 10, p. 230.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

An area of highly silicified latite exposed on the surface to the south and east of previous workings has been mapped and studied by engineers of the American Smelting & Refining Co. The similarity between this exposure and that adjacent to other areas from which production has been obtained influenced the organization in undertaking the exploratory program.

Development and mining. - The early development was by two shafts - the Genessee and the Vanderbilt - both sunk on areas of silicified latite. As previously stated, it was learned later that both operations were obtaining production from the same source, and the companies were merged. As the ore was extracted from the upper levels, the shafts were abandoned, and access was gained by an adit about 800 feet in length. A shaft reported to be about 700 feet in depth was sunk near the face of the adit. An adit at a lower elevation, known as the Joker tunnel, also was driven to its connection with the shaft. Present operations were carried out through the upper adit at an altitude of 10,749 feet at the portal. The upper adit was chosen for operations because drifts and crosscuts extended considerably farther in the direction of the area to be investigated. The rehabilitation of the adit level, approximately a mile in length, was a major project in itself. It was necessary to replace all track and retimber areas in which the support had failed.

The exploratory work comprised driving three headings from near the face of the adit level. The No. 1 crosscut was driven slightly west of south a distance of about 1,000 feet. The area entered by the crosscut was being investigated further by diamond core drilling. The No. 2 crosscut had been driven about 1,500 feet southwesterly. No. 3 crosscut had been driven southeasterly about 330 feet. Diamond core-drill investigation of the areas penetrated by these headings had been planned for 1948.

Compressed air for the operation of pneumatic mining equipment was furnished by a 1,500-cubic-foot capacity, electrically powered compressor. It was estimated that the capacity of this compressor at that altitude was approximately 1,000 cubic feet per minute.

Drilling was done with conventional column-mounted drifting machines, although one crew was using a "Finn board" mounting rather than the column. The "Finn board" mounting is merely a plank with a hole for inserting the cone of the drifter slide and is held in place by the mucking machine. Some of the ground was broken by rounds consisting of two cut holes and three lifters, whereas it was necessary to use rounds consisting of 20 holes in other areas. In general, about 6 feet is pulled with the round, and overbreak is the rule rather than the exception.

Tramming equipment consisted of a 2-1/2-ton Mancha and a 1-1/2-ton Atlas battery locomotive. The company maintained and serviced two batteries for each locomotive as well as individual charging equipment for each. They used C.S. Card, type Z, 16-cubic-foot end-dump cars on track set at 22-inch gage.

The underground work, comprising crosscutting and diamond drilling, was done on a contract basis. The company furnished all equipment and

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

supplies for driving the crosscut, but the contractor of diamond core drilling furnished all equipment of that type.

Lost Day Mine

The Lost Day mine, situated in sec. 32, T. 43 N., R. 7 W., N.M.P.M., Ouray County, Colo., was being operated during 1947 by Ben H. Simpson, 804 Chipeta Avenue, Grand Junction, Colo. Mr. Simpson has a lease with an option to purchase one-half interest from the owner, Earl A. Alexander, of Ouray, Colo.

Access to the property is by U. S. Highway 550 from Ouray to Ironton in the valley of Red Mountain Creek, and thence easterly and northerly about 5 miles by a primitive truck trail to the mine. Improvement of this road was approved during the life of the access-road program, and although grades are very steep at some parts, the grade favors the load, and four-wheel drive trucks negotiate the route. Further improvement on the access road was approved during June 1944.

Available records indicate that during 1916 and 1917, 1,032 tons of ore with a weighted average content of 45.4 percent combined lead and zinc was shipped to the American Zinc Co. and the U. S. Smelting, Refining, & Mining Co. at an average net value of $45.13 per ton.

The property was again operated during 1942, when, according to smelter certificates, 32.977 tons of ore was sold to the U. S. Smelting, Refining & Mining Co. at a net average return of $16.44 per ton.

Production during these periods was from surface exposures, tunnels, and pits.

The area is a landslide of considerable extent, and previous production is from that portion of the vein within the slide. Mr. Simpson began work with a bulldozer in an effort to expose the deposit in situ. During this operation, 100 tons of ore was recovered from pods that remained intact within the slide material.

It is possible that the northerly trending vein, which dips easterly into the hill at about 30° to 45°, represents the undisturbed deposit. However, it may also be possible that it is in a larger, more consolidated mass of landslide material. Additional work will be required before the question is solved definitely.

The 20 feet of drift completed disclosed a vein averaging 5 to 6 feet in width, composed almost completely of carbonates, locally termed "sand carbonates," with some sulfides. Thus far the ore has been broken down with picks or bars, and blasting has not been necessary. About 200 tons of ore has been shipped, including that in transit during early December 1947. The average of assays indicates a content of 10 to 12 ounces silver and 0.02 ounce gold per ton, 30 percent lead, no zinc or copper, 5 percent iron, and 7 percent sulfur.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The ore is being shipped to the American Smelting & Refining Co. plant at Leadville, Colo.

The development of consequence has been the attempt to locate the vein in place by removal of the slide material. The steep mountain side afforded ample disposal space and greatly facilitated removal of material with that type of equipment. Mr. Simpson[38] estimates that 75,000 yards of material has been removed by this method. The very short amount of drifting is not sufficient to determine the attitude of the deposit, nor will it more than suggest the type of future development. However, the operators plan to continue work during the 1948 season, which probably will open sometime in May or June depending on the ability to remove snow from the roadway. Construction of ore bins and storage facilities will receive consideration early in the coming season, as will certain road improvements.

Ida L.

The portal of the Ida L. mine is a short distance (probably 600 or 700 feet) west of U. S. Highway 550 at Ironton, about 8 miles south of Ouray, Colo. The property, consisting of four patented and three or four unpatented claims, is adjacent to the west side line of Ironton townsite near its northwest corner.

The owners, Harry and Milton Larson, reside at the property, but have leased it to W. C. Francis of Knoxville, Tenn. Information obtained in September 1948 indicated the property was again idle.

Production records were not available, but conditions indicate that it must have been very small.

Description of the deposit. - The deposits comprise two westerly trending veins that intersect the San Juan tuff exposed in that area. The most northerly vein is nearly vertical, but the other dips about 65° to the southeast. These veins are composed principally of quartz and, like other veins of this type, vary somewhat in width but will probably average about 5 feet. Galena, sphalerite, and some chalcopyrite and pyrite occur locally. The ore also contains some silver and gold. Francis shipped 9 tons of ore to the American Zinc, Lead & Smelting Co. custom mill at Ouray, which was settled for on the basis of 12.05 percent lead, 7.8 percent zinc, 7.6 ounces silver, and 0.025 ounce gold per ton, but copper is not mentioned. Information concerning other small shipments is not available.

Development and mining. - Access to the first vein is gained by a crosscut adit driven on a westerly course about 180 feet to its intersection with the vein. A drift was driven westward along this vein, but beyond 200 feet from the crosscut it is caved and inaccessible. A second crosscut has been driven westward from this drift to its intersection with the second vein. A small amount of drifting has been done along this vein in both directions from the crosscut.

38/ Personal communication.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

A winze has been sunk on ore in the first vein, but when visited it was flooded and inaccessible. An exploratory raise was in progress above the drift near this point, and the drill holes had begun to show signs of approaching the ore. A raise on ore exposed by the drift on the second vein was in progress during the early part of June 1948. Equipment at the property comprises a portable compressor of 210 cubic feet per minute capacity and the necessary air drills and accessories.

Silver Crown

The portal of the Silver Crown crosscut adit is on Mill Creek, about half a mile from U. S. Highway 550 in the vicinity of Chattanooga. This crosscut was intended to afford access to the Precious Metals property situated on the San Miguel River drainage side of the high rugged ridge to the west. It did not reach its objective and now affords access to veins that are being explored by the present operators.

The organization is headed by C. A. Baker, 4419 Steel Street, Denver, Colo. At the present time (1948), three men are employed on one operating shift.

Exploration of a quartz vein that is intersected by the adit between 2,300 and 2,400 feet from the portal is now in progress, the objective being to intersect this vein with another vein exposed by the crosscut.

The adit was started during the 1890's, and its location is shown on the Economic Geology map prepared in connection with Folio 120, surveyed by the U. S. Geological Survey during 1895 and 1900 to 1901; however, no mention is made of the operation in that publication. The total length of the adit is reported to be between 3,100 and 3,200 feet.

Compressed air for the operation of the drills is furnished by a semi-portable gasoline-powered compressor estimated to have a capacity of about 285 cubic feet per minute.

A battery locomotive is used for haulage of rock and other materials. A gasoline-powered generator has been installed at the portal in order to maintain the locomotive batteries in operating condition.

Ouray District (Uncompahgre)

The Ouray mining district, also referred to as the Uncompahgre district, includes some 15 square miles in the vicinity of Ouray, Colo., and comprises the northern portion of the San Juan Range (fig. 2). To the south, the indefinite boundaries extend to the Upper Uncompahgre district in the vicinity of Bear Creek, about 4 miles south of Ouray. To the southwest the Canyon Creek drainage to the proximity of the Camp Bird surface installations, about 6 miles southwest of Ouray, is considered a part of the district.

The canyon of the Uncompahgre River intersects the formations through the center of the district, and Ouray, the county seat of Ouray County, is

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

situated within the narrow valley. U. S. Highway 550 enters the district by way of the valley and is considered to be a "high-gear" route until it passes through Ouray enroute to Silverton by way of Red Mountain Pass. Ouray is the terminus of the branch of the narrow-gage Rio Grande Western Railroad, which serves the area. Several historically well-known mines, among them the American Nettie, have made considerable contribution to the past production of the Ouray area. Currently, the Bachelor, together with some irregular shipments from the Mineral Farm mine, comprise the only producing operations. The Portland mine should be in production sometime during 1948.

General Description of the Deposits

The Uncompahgre River and Canyon Creek have exposed the rocks for a considerable vertical distance, ranging from late Cretaceous through the Potosi volcanics of Miocene age, within a comparatively small area.39/ Erosion by these streams and their tributaries has exposed mineralized veins within the sedimentary rocks, which would have been completely concealed.

Bachelor Mine

The American Zinc, Lead & Smelting Co. has been operating the Bachelor mine during 1947 and has plans for further expansion at the property. This operation is a consolidation of the Bachelor Consolidated, Pony Express, and Neodesha properties as well as the Syracuse crosscut tunnel and surface installations. These properties are about 2 miles north and between 1 and 2 miles east of Ouray. Automotive equipment leaves U. S. Highway 550 at the American Zinc, Lead & Smelting Co. mill about 2 miles north of Ouray and traverses a mountain road to the Syracuse tunnel portal and along Dexter Creek to the portal of the Khedive adit. The compressor and blacksmith shop are at the portal of the Syracuse tunnel, and only timber sheds and some small storage facilities are at the portal of the Khedive adit.

Description of the deposit. - Production at the Bachelor mine is from a vein of somewhat variable width and comprised principally of quartz that strikes N. 80° E. and dips slightly to the south. Favorable horizons on the vein are further mineralized with galena and sphalerite, which contain appreciable quantities of silver and small quantities of copper and gold. Although the ore is complex, it is amenable to concentration by flotation in the company's treatment plant.

At this place the country rock is composed principally of sedimentaries with a slight easterly dip. These sedimentaries are below the Telluride erosion surface, which forms the base of the San Juan tuff, the productive horizon of the vein deposits in the northwest exterior portion of the Silverton caldera.

Burbank states that it is difficult to define the boundaries of some of the formations. It is probable, therefore, that the deposit being

39/ Work cited in footnote 10, p. 155.

Generated on 2024-09-19 22:04 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

exploited at the Bachelor mine is within formations classified as Upper Jurassic and is probably the Morrison. The "Pony Express beds," of the Wanakah formation, immediately below the Morrison, are the more widely mineralized beds of the district. However, the eastern part of the mine is within the Dakota sandstone owing to the dip of the beds.

The ore shoots appear to be formed at structures locally termed "miner's roll of vein." These conditions probably are the result of a slight lateral movement along bedding planes of the sedimentary rocks, which prepared a zone more favorable to the deposition of ore minerals. Mineralization is closely associated with the Bachelor clastic dike in the upper levels only, and the vein may be on either side or wholly within the dike. This and other clastic dikes in the area appear to consist of injected breccia and have been the subject of considerable study.40/ The exact connection between the ore bodies and the clastic dike is not definite, but the vein does not appear to be productive unless it is in close proximity to the dike.

Development and mining. - The terrain in the area has influenced the type of development to a great extent. The western part of the property has been developed by adits at various altitudes. To the east, on the Wedge claim, access to the workings was by a shaft, and adjacent to this claim the Bachelor Consolidated property was developed through the Khedive crosscut adit about 700 feet in length. The Khedive level and work above it was driven from this adit. Work below this level was carried on through the Bachelor shaft, which connects with the Syracuse tunnel, designated as the 1,000-foot level. Actually this tunnel level is somewhat less than 1,000 feet below the Bachelor Discovery tunnel, which is slightly over 300 feet above the Khedive adit.

The present organization has been operating the 500- and 700-foot levels to the east of the Bachelor shaft. Ventilation has been sufficient for operation, and the air lines installed by previous operators were still intact. The rehabilitation work will proceed as conditions permit. The 500-foot level to the east was rehabilitated, extended, and has made available the ore indicated by the stopes along the "roll" above the Khedive level. This part of the mine is in the Dakota sandstone, which contains strata of impure limestone or marl.

The ore was being extracted by extending the drift and raising from it to the ore body. The nearly horizontal ore body formed along the "roll" will eventually be at drift height owing to the dip of the sedimentaries that form the country rocks.

The ore is generally drilled with a stoper drill, although the deposit is very flat. In some instances, not all of the ore is taken out with one round, and a jackhammer is used to take up bottom. This method permits complete extraction, even though the outline of the ore body is irregular.

40/ Work cited in footnote 10.

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The broken ore is moved to the chutes with a scraper operated by a compressed air-powered, double-drum slusher hoist. One installation will serve the 50 feet or more on each side of the service raise by moving the scraper across the manway and chutes, so that the service raises can be as much as 100 feet apart. The exploratory raises have not been held to a definite interval, but the position generally depends on local conditions.

An old-style first-motion steam hoist has been converted to an air-operated hoist, and is now in use. The loaded cars are hoisted to the Khedive level and trammed to the ore bin at the portal. The installation is satisfactory for present requirements and is maintained in a safe, orderly condition. The ore is transported from the mine to the mill by trucks of one of the local trucking organizations.

Portland Mine

The American Zinc, Lead & Smelting Co. has also obtained control of the Portland mine, situated in the area known locally as the Amphitheater.

Development work comprising a crosscut adit constitutes the only work currently in progress. It is estimated that the crosscut will be about 2,000 feet in length when completed, and is intended to develop the intersection of the Oak Street and Denver veins. An appraisal of the results will not be possible for some time.

Non-Operating Mines

Maps prepared by Cross, Howe, and Irving[41] show the location of 33 mines in the Ouray or Uncompahgre district of Colorado during 1904 to 1906. Later publication by Burbank[42] dealing with the structure and ore deposition in the Ouray district lists some 45 mines and prospects in 1930.

Examination of historical, geological, and other articles suggests that the American Nettie mine was more important than the other now inactive mines. This mine is about a mile, possibly a mile and one-half, north of Ouray, on the cliff that forms the east wall of the canyon of the Uncompahgre. The aerial tramway cables are still in place across U. S. Highway 550, the river, and the right-of-way of the Rio Grande Western Railroad. The buildings attached to the cliff and still intact are visible from the west or railroad side of the valley.

The ore bodies were formed by replacement in a quartzite bed at the base of the overlying black, carbonaceous shale. In the Ouray district these sedimentary beds have a gentle easterly dip of 5° to 10°.

The ore comprised principally limonite containing gold, most of which was in the free state, either fine or in the form of wire or nuggets. Mention is made of gold ore yielding as much as 30 ounces per ton, and, although the silver was secondary in importance, the ore contained as much

41/ Work cited in footnote 10.
42/ Work cited in footnote 10.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

as 60 ounces per ton in some parts of the mine. According to Irving and Cross:43/

> Between 1889 and January 1905, the mine produced 23,641,316 pounds of ore valued at $1,464,923.35. This would give an average value of $123.12 per ton, or, roughly, 6 ounces of gold per ton of sorted rock.

The limonite is an oxidation product of the pyritic deposits, and gradually passed out of the zone of oxidation as the mine workings progressed eastward. Economically important minerals apparently were rare east of the Jonathan dike; at least, available information indicates that the more valuable ore was on the west side of it.

At the nearby Wanakah mine, the deposits of gold-bearing ores were formed at a somewhat lower horizon than at the American Nettie. The mineral characteristics of the contact-metamorphic class were deposited in the limestones of the Pony Express beds at or near the bottom of the Morrison formation. According to Burbank:44/

> The main ore channel of the American Nettie essentially parallels that of the Wanakah mine and probably is related to the same zone of flexing, though the two are separated about 800 feet stratigraphically and from 500 to 600 feet horizontally.
>
> The gangue of the pyritic ore is similar to that associated with pyritic deposits in the contact-metamorphic zone except for the absence of contact silicate. The principal minerals are sericite, quartz, chlorite, and carbonates, but there is in addition, some barite. The ore minerals include sphalerite, chalcopyrite, galena, tennatite, tellurides of gold and silver, and native gold.

The Mineral Farm mine is southwest of Ouray, a short distance from the Canyon Creek road between Ouray and the Camp Bird mine. Operation of the mine has been somewhat erratic and generally on a leasing basis. It was operated through 1947 by Earl A. Alexander, of Ouray, but the operation was suspended early in 1948 because of inability to arrange a satisfactory leasing agreement, and the property is now idle.

According to Burbank,45/ the ore body exploited at this property is pipelike and has been developed for over 1,400 feet on its inclination of 15° to 20°. The deposit is the replacement type and was formed at or near contact of the Molas formation with the Ouray limestone. In type, the deposit is similar to the "channels" of the Tintic district of Utah, but it does not compare with most of them in the matter of grade or quantity.

The principal ore minerals are galena, sphalerite, and tetrahedrite in association with quartz and some barite.

43/ Work cited in footnote 10, p. 18.
44/ Work cited in footnote 10, p. 223.
45/ Work cited in footnote 10, pp. 220-223.

Generated on 2024-09-19 21:55 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Burbank suggests that other deposits of this type might be found at other points along this contact. However, the comperatively small size of the Mineral Farm deposit discourages the expenditure of funds for extensive prospecting.

The Calliope mine is situated on Dexter Creek north of the Bachelor. The few statements to be found in the various publications indicate the deposit to be a fissure similar to that exploited by the Bachelor mine.

According to Henderson,46/ 6,184,307 pounds of ore produced up to July 1890 contained 1,418.67 ounces gold, 354,363 ounces silver, and 695,811 pounds of lead.

Upper Uncompahgre, Poughkeepsie Gulch, and Mineral Point

The drainage of the Uncompahgre River south of Ouray from the proximity of Bear Creek Falls to the vicinity of the junction with the Poughkeepsie Gulch branch is designated as the Upper Uncompahgre district. The area on the western flank of Mt. Abrams, including the northern part of Ironton Park and the drainage into Red Mountain Creek from Hayden Mountain, comprises the south and western portions of the district. The Red Mountain district adjoins this area on the south, but the common boundary is very indefinite here, as are all such boundary lines throughout the San Juan region.

The Poughkeepsie Gulch district, comprising some 6 square miles adjoining the Upper Uncompahgre district on the east and south, is composed principally of the drainage of the Poughkeepsie Gulch branch of the Uncompahgre River. To the south of Mt. Abrams, the Ouray-San Juan county line becomes the western boundary. To the east and adjacent to it is the Mineral Point district, which includes the area between the Uncompahgre and California Gulch to the common corner of San Juan, Ouray, and Hinsdale Counties. American Flats, the northeasterly flank of Engineer Mountain in Hinsdale County, is generally included with the Mineral Point area for the sake of convenience.

The Upper Uncompahgre district is served by U. S. Highway 550, which traverses the gorgelike canyon of the Uncompahgre to its confluence with Red Mountain Creek, and by way of the canyon of that stream to Ironton Park enroute to Red Mountain Pass and Silverton. To the east of Highway 550, the primitive road traversing the narrow, steep-walled canyon of the Uncompahgre was improved to the Michael Breen mine by the wartime access-road program. Above the mine the route by way of Mineral Point to Animas Forks is maintained to some degree in summer by Ouray and San Juan Counties. The route by way of Engineer Pass to Lake City has not been opened for a considerable time. The Poughkeepsie branch of the route generally receives some attention during each season. It is possible to travel by way of Mineral Point and Animas Forks to Silverton during this period, but it is suggested that a jeep or other four-wheel drive vehicle should be used for the trip.

46/ Work cited in footnote 6.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

This area is one of precipitous terrain, subject to heavy snowfall in winter and almost daily thunderstorms during the short summer season. Frequent snowslides result from the heavy snowfall and steep terrain, whereas the thunderstorms that sometimes reach cloudburst proportions often result in slides of talus with some mud. A portion of the heavy annual precipitation is absorbed by pervious structures such as fault zones, fissures, and veins, so that the rocks contain all the moisture it is possible for them to hold.

The climatic conditions, together with the type of terrain at altitudes ranging from about 9,000 feet at Bear Creek Falls to nearly 13,000 feet at Mineral Point, has not been conducive to extensive development. In addition to these physical conditions, the demonetization of silver and the increase in sulfide content of the ore, especially zinc, with the attendant increase of penalty, have further retarded exploration.

The Bureau of Mines gave especial attention to the Poughkeepsie Gulch district during the summer of 1946, and a reconnaissance of approximately 6 square miles was completed. The area was mapped with especial attention to mine workings that were at all accessible and to outcrops of veins. During this project, some 800 indicative samples were taken and sent to the Salt Lake City laboratory for assay. The work resulted in recommendations for an exploratory program.47/

The area has received attention from the U. S. Geological Survey, and considerable work has been completed, the most recent by Kelley.48/

The Michael Breen is the only mine now operating in the Upper Uncompahgre district, and the Mountain Queen, at the head of California Gulch, the Little Ida and Burrows, about 1-1/2 miles down the Gulch, are the only properties to record production from the Mineral Point district during 1947. The Mountain Queen is at the southern edge of the Poughkeepsie Gulch district, but it is questionable whether the Little Ida and Burrows are in the same or in the Mineral Point district.

General Description of the Deposits

Most of the veins of the Upper Uncompahgre district appear to be associated with the diastrophism attendant upon the Dunmore fault, which, according to Kelly, has a horizontal displacement of not less than 2,800 feet and possibly more than 4,500 feet. This fault strikes somewhat north of west and dips southward at a very steep angle, whereas the veins in this area are at nearly right angles to it and have a general north-south trend. There are some veins with a general east-west trend at the northern fringe of the area, but there are no indications of veins radiating outward from the Silverton caldera, as in other districts. Throughout most of the Silverton-Telluride-Ouray region the exposed formations are in a relatively

47/ Hazen, Scott W., Jr., Lead-Zinc-Silver in the Poughkeepsie District and Part of the Upper Uncompahgre and Mineral Point Districts, Ouray and San Juan Counties, Colo.: Bureau of Mines Rept. of Investigations 4508, 1949, 110 pp.

48/ Work cited in footnote 10.

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

horizontal position, but the northwest portion of this district north of the Dunmore fault has been tilted. The position is readily discernible from Highway 550.

Throughout most of the Poughkeepsie Gulch and Mineral Point districts the veins are predominantly northeastward in their trend, probably radiating from the Silverton caldera.

The sedimentaries prominent in the Uncompahgre district are exposed in the northwest portion of the Upper Uncompahgre in the vicinity of Canyon Creek. To the south and east, the Telluride conglomerate thins and is not present over most of the area, whereas the San Juan tuff, productive in the northwest sector, fingers into the Eureka rhyolite. Throughout most of the area the rhyolite is overlain by the Silverton volcanics, the Burns latite, and pyroxene andesites.

Michael Breen Mine

The Southwest Metals Co. of Ouray, Colo., controls the Michael Breen (fig. 2), locally known as Mickey Breen, and Mountain Monarch properties. The group is comprised of some 16 claims, a number of which are patented, and the rest are held by location. This property is in the Uncompahgre River Canyon about 1-1/2 miles east of U. S. Highway 550. The road from the highway to the mine was improved under the wartime access road program and is maintained by Ouray County, which includes snow removal during the winter season. F. C. Leibhardt, of Ouray, Colo., is the principal stockholder, and Oren Fulgum, also of Ouray, is mine superintendent in charge of operations.

The property is reported to have been operated first during 1890 and intermittently since then, the latest being on the Mountain Monarch, which was started in 1939. According to Kelley,49/ "*** private reports estimated in 1917 that ore worth more than $300,000 had been shipped from the Mickey Breen group, three-fourths of it coming from the Mickey Breen deposit." The same source reports that 1,226 tons of ore was produced from the Mountain Monarch, to and including 1943, from which 71.54 ounces gold, 7,140 ounces silver, 10,039 pounds of copper, 1,941,927 pounds of lead, and 158,165 pounds of zinc were recovered. The first production from the Mountain Monarch is reported to have been during 1900, although the records of production throughout the district appear to be incomplete during the early days.

Description of the deposit. - The Michael Breen workings exploited the Michael Breen, Royal Consort, and Helen veins, whereas at the Mountain Monarch only the Monarch vein has been explored.

It was formerly considered that the Mickey Breen vein was the eastward continuation of the Dunmore fault fissure, but more recent work by Kelley indicates that the Mountain Monarch vein is the continuation of the Dunmore fault instead of the Mickey Breen.

49/ Work cited in footnote 10, p. 374.

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Kelley also states that the Michael Breen vein ranges in width from as little as 6 inches to several feet, and probably averages about 2 feet. It has a nearly east-west strike and is inclined very steeply (80° to 90°) to the south throughout most of its course, although at one point it has about the same dip to the north. The vein comprises principally quartz, further mineralized with galena, sphalerite, chalcopyrite, pyrite, tetrahedrite, and appreciable amounts of rhodochrosite. He also states that an old report mentions 16 samples from this vein that averaged 0.09 ounce gold and 18 ounces silver per ton, with 2.17 percent copper, 10.5 percent lead, and 18.5 percent zinc, but no record was given of the position or width of vein matter sampled.

It is reported that a considerable tonnage of stope fill from previous operations of sufficient grade for economical treatment is available and will be drawn as soon as facilities are prepared. According to Kelley,50/

> The Royal Consort vein strikes N. 45° E. and dips 50° to 70° N.W.; intersects the Helen vein a short distance east of the tunnel. The Helen vein is vertical and strikes N. 86° W., or parallel to the Mickey Breen vein, with which it is almost identical in width and type of vein matter. The Royal Consort vein is only about 6 inches wide between the tunnel and its intersection with the Helen, beyond which it widens to 18 inches.

The vein at the Mountain Monarch, or Monarch, as it is locally designated, has a general east-west strike and dips south at a steep angle. It ranges in width from 5 to 10 feet, and there is a considerable amount of gouge on the walls throughout most of its length. As is common with other veins throughout the region, the vein matter consists principally of quartz containing galena, sphalerite, some chalcopyrite, and pyrite. This mine was surveyed and a map prepared by Kelley during the course of the U. S. Geological Survey work in the district.

Development and mining. - The Southwest Metals Co. has concentrated principally on development and exploration during the past year (1947). Access to the Monarch (Mountain Monarch) is gained by a crosscut which, for some unknown reason, was driven on a curving course and intersects the vein about 300 feet from the portal. The portal of this crosscut is at the road grade level, altitude given by Kelley as 9,776 feet. Drifts have been driven along the vein to the east and for a short distance to the west. Some stoping had been done along the vein, and some exploratory raises had been driven, but the principal operation for some time has consisted in taking up bottom through the crosscut and along the vein. The excessive grade on which the early work had been driven hampered tramming to such an extent that it was considered worthwhile to make the necessary grade change, and at the same time some of the sharp curves were relieved. The drift was lowered nearly 4 feet at the face in order to bring it down to grade.

50/ Work cited in footnote 10.

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The bench was drilled with jackhammers, and the broken material was loaded into end-dump cars by a mucking machine and trammed to the surface. A considerable portion of the material was shipped to the American Zinc, Lead & Smelting Co. custom mill at Ouray.

During the latter part of 1947, a raise was in progress at a point about 70 feet above the lower tunnel or No. 2 lower level. It consisted of a manway in the center and a chute on each side. The drift sets from which the chutes are suspended are of round timber. The chute linings are nailed to round timber stulls.

Mineralization of sufficient grade to be classed as ore was showing in the back of the raise, and cutting of a station was in progress. Drifts to both the east and west were planned, together with continuation of the raise, which will approximate 290 feet when completed to the next level.

The No. 1 upper level, from which most of the operation has been in progress, is also entered by a crosscut adit, the altitude of which Kelley gives as 9,993 feet. A stope near the intersection of the vein by the crosscut has produced most of the ore, but a sublevel driven to the east has exposed a lead-zinc shoot of sufficient grade to warrant driving a raise from No. 1 upper level to the sublevel. A raise also has been extended 165 feet from the No. 1 upper level, and the level at the top of this raise has been driven 95 feet to the west. It is estimated that an additional 30 feet in this direction will break through to the surface above the level known as the No. 1, or upper level. This drift has been extended 85 feet to the east and has exposed the vein, which has been sufficiently mineralized so that it can be classed as ore, and a substantial ore reserve is indicated.

The raise in progress from the No. 2 lower level will enter the No. 1 upper level about 30 feet from the bottom of the 165-foot raise. This arrangement will eliminate the need for the aerial tram now in use between the No. 1 level and the ore bin at the roadway level.

The No. 2 lower level will become the main haulageway, and electric haulage is planned, but a mule is now used for tramming.

The company employs 12 to 15 men, and nearly all underground work is done under contract. The drifts and raises are paid for on a footage basis, and tramming is on a tonnage basis. Timbering is also installed under contract. The company furnishes supplies and materials used by the contractors.

A local trucking firm transports the ore from the mine to the custom mill of the American Zinc, Lead & Smelting Co. at Ouray, at the rate of $1.75 per ton.

Considerable repair to surface installation has been in progress. This work has consisted of constructing snow sheds, enclosing ore bins to eliminate freezing of the ore in winter, and repairing shops and other buildings.

Generated on 2024-09-19 21:55 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

A 425-cubic foot, Diesel-powered compressor furnishes compressed air for underground operations. A 250-cubic foot compressor has been installed and is maintained in a standby condition.

All material for installation of electric power has been purchased, and surveys have been completed. As soon as the transformers are available, installation will begin.

Mountain Queen Mine

The Mountain Queen mine (fig. 2) is at the head of California Gulch at an altitude of 12,790 feet in T. 42 N., R. 7 W., 16 miles northeast of Silverton, Colo. The property is owned by the Eureka Mining & Milling Co. of Denver, Colo., and is being operated by the Mountain Queen lease, represented by Arthur R. Walker, Silverton, Colo.

The severe climatic conditions at this altitude limit operations to the summer months, generally from the last of May or the early part of June to about the middle of October. This condition presents a serious handicap to prospecting and mining throughout both the Mineral Point and Poughkeepsie Gulch districts.

An access road was approved and constructed by the wartime access roads program. The road traverses California Gulch from Animas Forks but will not receive maintenance or snow-removal attention until other San Juan County roads have been opened.

Description of the deposit. - The mine workings exploit sulfide lead-zinc ore bodies within a vein consisting predominantly of ribs of quartz with bands and stringers of pyrite. The vein or zone ranges from 50 to 150 feet in width. At some places there are horses of altered country rock between the quartz ribs. The zone strikes N. 45° E. on the west end of the Mountain Queen claim and turns eastward near the shaft, which is near the north central part of the claim. Many pits, cuts, trenches, and shallow shafts were opened on the vein and are all located on exposures of pyrite, either in the quartz or in the siliceous material between the quartz ribs.

The Geological Survey and Bureau of Mines records indicate that from 1901 through 1942 the mine produced 1,447 tons of ore containing 32.16 ounces gold, 19,663 ounces silver, 9,601 pounds copper, 366,931 pounds lead, and 135,339 pounds zinc. The mine is credited with 250 to 500 tons production each year from 1941 to 1946.

Development and mining. - The Mountain Queen shaft is over 400 feet in depth and was sunk on a lead ore shoot. An adit started in the bottom of California Gulch was driven 1,500 feet toward the shaft, and a raise reported to have been driven from the end of the adit failed to connect with the shaft. The shaft is in good condition to the water level (about 200 feet), and current operations have been carried on to the southwest on this level.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Stopes above a northerly drift on the 70-foot level have broken through to the surface and are partly caved, and workings on a parallel ore shoot south of the shaft also are caved. According to Kelley:51/

> It is one of the oldest workings in the district (Placer Gulch and Treasure Mountain) and in 1877 shipped 370 tons of ore to Lake City. This ore was carried by pack animals to Rose's Cabin (on Henson Creek, a distance of about 8 miles) at $3 per ton, and is said to have contained 30 ounces of silver and 64 percent of lead. The mine was most active from 1878 to 1880, and during one of these years is reported to have shipped $60,000 worth of ore.

Burrows Mine

The Burrows mine, a prospect (fig. 2), is situated on the north side of California Gulch at an altitude of about 12,000 feet, about 2 miles west from Animas Forks. This operation is served by the same branch of the Mountain Queen access road that provides access to the Little Ida mine, the adjoining claims.

The claims covering that portion of the Burrows vein together with other property in this area is owned by the trustees of the Frisco tunnel. The leasing company currently operating the property is under the management of K. E. Knapp of Silverton, Colo.

A comparatively small production has been recorded by previous lessees as well as by the present operators, but complete records are not available. Some of this ore was shipped directly to lead-zinc smelters, whereas other consignments were made to the Shenandoah-Dives Mining Co. at Silverton and the American Zinc, Lead & Smelting Co. custom mill at Ouray.

The strong eastward striking Burrows vein has been traced through the length of several claims, including the Little Ida to the west. Toward the east it becomes a part of or is interlaced with other veins having a general east-west strike. The vein material, like other veins in the district, is predominantly quartz. Locally, it is further mineralized with galena and sphalerite, which contains some silver and small amounts of copper. At the Burrows mine the copper content is negligible. The vein, as exposed on the surface and by the crosscut, reaches a maximum width of 6 or 7 feet and averaged about 4 feet throughout the mined area. It is not always mineralized sufficiently to be classed as ore across the full width.

One ore body mined partly by the present organization and by previous lessees produced about 1,000 tons and contained about 16 percent zinc, 10 percent lead, and 3 ounces per ton silver. No payment was received for copper.

51/ Work cited in footnote 10, pp. 448-449.

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The ore body was first exposed by surface pits and a shaft was sunk on the ore. A crosscut adit was driven 85 feet on a northerly course to give access to the vein. A drift was then driven westerward along the vein for a distance of slightly more than 85 feet. The drift entered an ore body when it had progressed but 5 feet from the crosscut. This ore body did not connect with the one exposed in surface excavation; however, it was stoped for about 30 feet above the level and was mined underhand for an unknown distance.

Later, a connection with the surface work was effected, and by the close of the 1947 season nearly all of that ore body had been extracted. The clean-up work was done by drilling jackhammer holes in benches, and the broken ore was drawn from a chute on the level and trammed to the ore bin on the surface.

A Chicago pneumatic compressor of 210-cubic foot capacity per minute furnished compressed air for the operation of air drills. The compressor is stationary and powered by a gasoline-driven motor.

The property was being operated on a royalty basis, the owners receiving 7-1/2 percent of the custom-mill returns after payment of milling and trucking charges.

The mining operations, drifting, and breaking ore were paid for on a contract basis. The contract for drifting was at the rate of $8.25 per foot; the company furnished all supplies and equipment. The ore was broken and trammed to the ore bin for $2.75 per ton.

The ore was transported from the mine to the American Zinc, Lead & Smelting Co. mill at Ouray by a Silverton trucking company at $4.50 per ton. A truck generally made two trips per day, and during most of the favorable operating season the mine furnished two truckloads of ore per day.

Little Ida Mine

The Little Ida mine (fig. 2) is in sec. 2, T. 42 N., R. 7 W., on the north side of California Gulch, about 2 miles west of Animas Forks, at an altitude of 11,500 feet. The property was surveyed for patent during 1905 and has been operated on a small scale at various times since then. It has been credited with occasional shipments of an unknown tonnage of lead-zinc ore.

A branch of the Mountain Queen access road was constructed during the time the program was in effect, and affords access to the workings by automotive equipment. Like the Mountain Queen mine, operations are confined to the short season, but it is generally possible to operate somewhat later in the fall because of the lower altitude.

Ray C. Barnes, of Silverton, Colo., operated the property during the 1947 season. A considerable portion of the time was consumed in surface preparations, but a small tonnage of ore was produced from the development completed before the close of the season (1947).

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Present operations have been carried out on the Burrows, a strong eastward-striking vein, which in general dips north. There are, however, branches or splits on the south side of the vein that dip to the south. This vein has been traced for some distance to the east where it is the same, or interlaced with other easterly striking veins designated by other names. Westerly it becomes obscured by alluvium.

The Little Ida vein, approximately parallel to the Burrows, is a short distance to the north. In general it dips to the south and has been traced eastward to its junction with other veins of the area. This vein was exploited during the early days and was the source of the production of the Little Ida mine.

North-south cross veins or fractures have produced ore at the intersection of both the Little Ida and Burrows veins and is the object of present development.

The Burns latite forms the surface at the higher elevations, whereas the Eureka rhyolite is exposed on the slopes nearer the bottom of California Gulch. These formations are of the Silverton volcanic series and form strong walls that permit mining by the shrinkage-stoping methods.

The ore shipped during the season averaged about 7 percent lead, 5 percent zinc, and 0.4 percent copper.

The development work completed this season comprised a short crosscut driven almost north to the vein. A drift had been driven 130 feet northeasterly along this vein. Some ore had been extracted by back stoping, but the distance to the surface was not sufficient to permit more than a limited production. Neither was it sufficient to warrant installation of chutes, so that the ore was broken onto the track and mucked up with a mucking machine.

The drilling in the drift was done with a heavy drifting machine mounted on an upright column. Detachable bits on round steel were used for both drifting and stoper drills. The bits were sharpened locally by one of the mining companies.

Compressed air for operating drills and mucking machine was supplied by a portable compressor. An extra receiver was installed to augment the supply.

Surface preparations comprised installation and housing of the compressor. An ore bin of about 25 tons capacity was prepared adjacent to the branch road to permit loading trucks.

Drifts and crosscuts are driven under contract. The current price paid for the work is $10 per foot, all supplies and equipment, including use of the mucking machine, being furnished by the operator. The ore, also, was broken on a contract basis, for which the operators paid $2 per ton, or 15 percent of net mill returns after all expenses had been paid.

Generated on 2024-09-19 21:55 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Gasoline to operate the compressor cost the company $0.227 per gallon at the bulk station in Silverton. The cost of other mining supplies was given as $400 per ton for powder at the portal of the adit, $33.90 per 1,000-foot spool of fuse, and $2.25 per 100 for caps.

The Shenandoah-Dives custom-mill base-treatment charge amounted to $4 per ton, but a credit of $0.20 per ton was allowed for the iron and insoluble content of the ore. The operators were paid for 85 percent of the lead, 62.2 percent of the zinc, and 85 percent of the copper. The local trucking company transported the ore from the mine to the mill near Silverton at the rate of $2.90 per ton in truck-load lots when drawn from the ore bin without handling.

Columbus Mine

The Foursome Mining Co., lessee of the Columbus mine (fig. 2) at Animas Forks, probably produced more tons of ore than any recent operation in the district. The company operations are directed by William Erickson of Silverton, Colo.

The portal of the crosscut affording access to the workings on the Columbus vein is situated at Animas Forks about 11 miles northeast of Silverton, Colo. During the early days, Animas Forks was a settlement of some consequence; now there remain but few dwellings that could be made habitable without almost complete rebuilding.

The Columbus vein, like others in the district, is predominantly quartz; locally it is further mineralized with galena and sphalerite. It strikes about N. 55° E., is nearly vertical in dip, and can be traced on the surface for several thousand feet. It is generally mined through a width of 10 to 15 feet in the more highly mineralized zones, although a few places have been mined to a width of 30 feet.

The ore contains an appreciable amount of talc from gouge within the vein and along the walls and is a source of considerable difficulty at the flotation treatment plants.

It was reported that the ore assayed 8 to 14 percent combined lead and zinc and contained about 2 ounces per ton of silver. The fact that operations were suspended shortly after the discontinuance of premium payments indicates the grade of ore that could be expected.

The crosscut through which mining operations are carried out intersects the vein about 1,200 feet from the portal and was driven on a N. 16° W. course. The drift along the vein from the intersection by the crosscut serves as the haulageway for ore mined above that level. The first drift above the haulageway was spaced at 120 feet, and the next above, or the second drift, is 90 feet above the first level. The second level opens to the surface about 25 feet above the North Fork of the Animas River to the northeast of the surface installations at the portal of the crosscut adit. The ore shoot between the haulageway and the first level above it was mined

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

by the shrinkage-stoping method. The broken ore was pulled from the stope before suspension of operations in the fall of 1947. This stope was also used as an ore pass for the transfer of ore from the second level to the haulageway. The work on this level comprised drifting and slabing of ore left on the walls by previous operators. A double-drum slusher hoist was used to move this material to the transfer points. A mucking machine was used for removal of broken rock while driving drifts or crosscuts. Production was 60 to 80 tons per day during most of the season.

The surface installation comprised a blacksmith shop, covered timber shed, and enclosed ore bins. Snow sheds protect all surface track lay-outs. A 315-cubic foot capacity portable and a smaller compressor furnished compressed air for mining. Both compressors are powered by gasoline motors.

All mining is performed on a contract basis. The ore is broken on a split-check basis, the company furnishing supplies and the men breaking the ore and dividing the returns after expenses such as transportation to the treatment plant were paid.

Silver Coin Mine

The Silver Coin mine (fig. 2) is about 1/2-mile southwest of the county road at the old townsite of Animas Forks, about 9 or 10 miles northeast of Silverton, Colo. William Erickson, manager of the Columbus mine at Animas Forks, is also in charge of operations at this property. The objective of the work is to better appraise the value of an east-west trending vein prospected on the surface and by an adit about 70 or 80 feet above the present workings.

The deposit comprises an east-west trending quartz vein about 5 feet wide and with a nearly vertical dip. It has been sparsely mineralized with galena, sphalerite, and pyrite. A small stope had been mined from the vein near the breast of the lower level. The minerals appear to be disseminated through the vein at this location but so sparsely that extraction would not be economical. It was reported that the material taken from the stope barely paid for milling and hauling.

The lower workings comprise a crosscut adit driven southwestward about 65 feet to intersect the vein and a drift driven west along the vein for a distance of about 365 feet. A raise was in progress at a point about 230 feet from the crosscut and was expected to break into the level above with another round or so. It was estimated that the distance between the two levels was 70 to 80 feet. This raise would afford access to the upper level behind a caved portion.

A semiportable compressor of about 310-cubic foot per minute capacity and powered with a gasoline motor furnished the compressed air for operation of mining equipment.

Generated on 2024-09-19 22:05 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Silverton Area

The Silverton area (fig. 2) includes the mines situated on land drained by the Animas River between Eureka and Silverton, commonly known as the Eureka and Animas districts. North and northwest of the Animas River the area is drained by Cement Creek and Eureka Gulch, and south and southeast it is drained by Arrastre Creek, Cunningham Gulch, and a number of smaller streams.

The area is one of rugged relief ranging in altitude from 9,300 feet at Silverton and 9,800 feet at Eureka to over 13,000 feet. Passable roads are maintained at least part of the year from Silverton up the Animas River, through Howardsville and Eureka to Animas Forks; also, from Silverton up Cement Creek to Gladstone, and from Howardsville up Cunningham Gulch (fig. 3). A few other access roads to various mines are available during summer, but travel on them depends on the use of low-gear and four-wheel-drive vehicles or tractors.

General Description of the Deposits

The northern portion of the area, wherein the principal producer has been the Sunnyside mine, is in an eastward-trending graben on the north side of the caldera. According to Burbank:52/

> Some of the faults have displacements of more than 1,000 feet near the Silverton caldera, notably the Sunnyside fault and associated faults that bound the graben on the northwest. Most of the production has come from a zone within about 1 mile of the central fault block of the main caldera, but some of the larger faults and fissures are mineralized throughout their length and have yielded ore at places along a stretch of more than 6 miles. A series of east-west to southeast-trending faults and fissures are aligned with and are essentially parallel to the central fault block, and these have been moderately productive within a belt about 2 miles outside the central block. A crescentic fault zone or ring structure, partly occupied by intrusive rocks and breccia swings around the southern end of the graben and continues north along the west side of California Gulch northeast of Hurricane Mountain. It separates the volcanic formations of the Sunnyside and California Mountain area from those at the head of Poughkeepsie Gulch in the Uncompahgre drainage to the northwest. The rocks of the Eureka area belong entirely to the Silverton volcanic series, and only a few small intrusive bodies of rhyolite and latite are exposed. Mineralization along the northeast veins is essentially limited at the southwest by the edge of the main down-faulted block and perhaps to some extent by the local ring structure mentioned.

52/ Work cited in footnote 10.

Generated on 2024-09-19 22:05 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The area drained by Cement Creek is within the caldera. The geology within this area has not been studied in detail; however, according to Varnes and Burbank,53/ "except for a few small intrusive bodies of rhyolite and latite, the exposed volcanic rock within the interior is mostly pyroxene andesite of the upper part of the Silverton volcanic series."

The part of the general Silverton area south and southeast of Silverton contains the Shenandoah-Dives mine, one of the principal mines of the San Juan region. The mineralized area occupies a belt several miles wide along the southern rim of the Silverton caldera. According to Varnes:54/

> A wide zone of curved faults within and on the south side of the Animas River Valley marks the margin of the caldera, and along them the caldera has subsided 1,500 to 2,500 feet relative to the rim. This subsidence is not expressed in the present-day topography but can be estimated from off-sets of the various volcanic units. Within the caldera the predominant rock type is pyroxene andesite, whereas to the south the rocks are rhyolitic, andesitic and latitic flows and breccias which normally occur lower in the section than the andesite. Two of the deep valleys south of Silverton expose pre-Cambrian schists below the volcanic rocks. The irregular pre-Cambrian surface rises to the south, so that 4 miles south of the Animas River the schist is well-exposed at the surface. Several elongate bodies of quartz monzonite intrude the greatly fractured and weak zone along the marginal faults and were, in turn, fractured and mineralized during the later period of ore deposition.
>
> The more productive veins of this area are approximately radial to the southern rim of the caldera or are in fractures that diverge from the radial veins. Some of these veins, such as the main system of the Shenandoah-Dives mine and the Nevada-Silver Lake vein are accompanied over part of their extent by dikes or andesitic or latitic composition. Another set of fractures trending more or less concentric to the caldera intersect the radial system at high angles. These are commonly filled with dike material and in places are mineralized, as at the Titusville mine. A series of steplike granite-porphyry dikes extends in a wide arc around the apparent southern limit of the radial vein system.

The Shenandoah-Dives Mining Co.

The property of the Shenandoah-Dives Mining Co., near Silverton, Colo. (fig. 2), represents a consolidation of the Shenandoah-Dives, North Star, and Mayflower holdings, which was effected during the latter part of 1925. These holdings cover the main vein through a length of about 8,100 feet. To the southeast the vein is under exploitation by the Highland Mary Mines, Inc. The conditions are best illustrated by the longitudinal section in the plane of the vein (fig. 12).

53/ Work cited in footnote 10.
54/ Work cited in footnote 11.

Generated on 2024-09-19 21:55 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

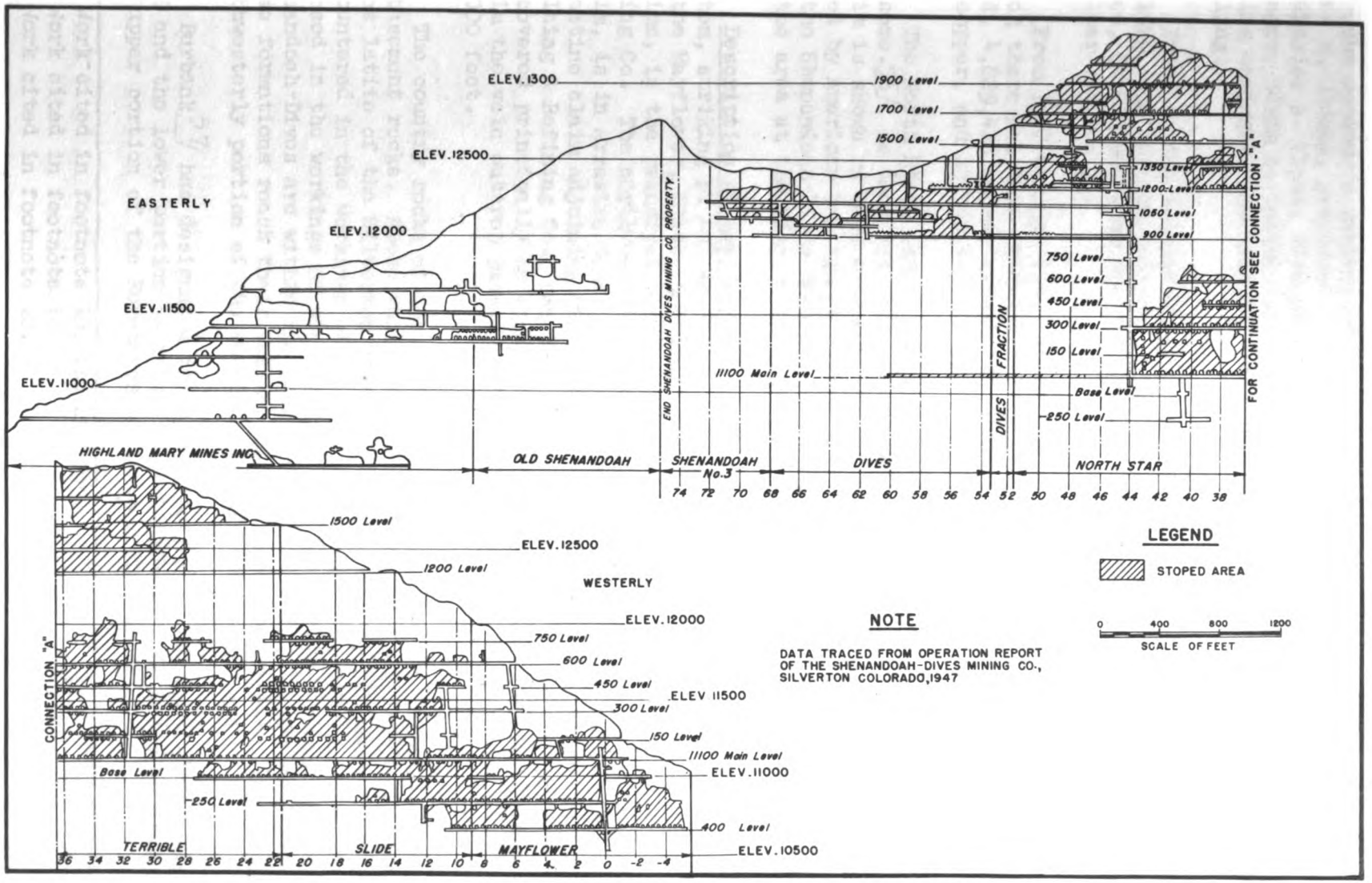

Figure 12. - Longitudinal section through Shenandoah Dives mine workings.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The company's general office is at 616 Finance Bldg., Kansas City, Mo., James W. Oldham, president. The organization is represented in Silverton by Charles A. Chase, vice-president. Operation heads are D. M. Kentro, manager, Edwin A. Larson, chief clerk, John Holmgren, mining, Joe Vota, mining engineer, Joe Arietta, aerial tramway, and B. Bonavida and J. Breymann, milling.

Prior to the initiation of operations by the Shenandoah-Dives Mining Co. in 1926, the records indicate a production of $1,250,000 from the Shenandoah-Dives, $2,000,000 from the North Star, and $250,000 from the Mayflower, net smelter returns.55/

From 1928 through 1947, 3,284,398 tons of ore had been milled, from which there has been produced concentrates containing 341,719,493 ounces gold, 4,829,415 ounces silver, 34,763,679 pounds of lead, 17,520,169 pounds of copper, and 15,469,491 pounds of zinc.

The North Star, Dives, and Highland Mary mines were mentioned by Ransome.56/ He does not mention the Mayflower, although the location of the claim is shown on maps accompanying his work. The Silver Lake mine, now owned by American Smelting & Refining Co. and operated on a leasing agreement by the Shenandoah-Dives Mining Co., was apparently the most important mine in the area at the time of Ransome's visit.

Description of the deposit. - The Shenandoah-Dives-Mayflower vein system, striking N. 45° to 50° W. and dipping 70° to the northeast., covered by the Mayflower, Slide, Terrible, North Star, Dives, and Shenandoah No. 3 claims, is the principal source of production by the Shenandoah-Dives Mining Co. The northwesterly portion of the vein, within the Mayflower claim, is in Arrastre Gulch at an altitude of about 11,200 feet. The Argentine claim adjoining the Mayflower to the north, owned by the American Smelting & Refining Co., has but little exploratory work, and the surface is covered principally by landslide debris. Southeast from the Mayflower claim the vein outcrop passed over Little Giant peak at an altitude above 13,000 feet.

The country rocks of the area rest upon the ancient Archean schists or basement rocks. Above this are the flows of the Eureka rhyolite and Burns latite of the Silverton volcanic series. The schist has not been encountered in the workings of the Shenandoah-Dives Mining Co., but has been exposed in the workings of the Highland Mary mine. The workings of the Shenandoah-Dives are within the overlying Eureka rhyolite and Burns latite. These formations reach their maximum thickness on the property toward the northwesterly portion of the section and thin out to the east.

Burbank57/ has designated the upper portion of the Burns formation as a tuff and the lower portion as a tuff-breccia member. He has also classed the upper portion of the Eureka rhyolite as a flow breccia.

55/ Work cited in footnote 10, pp. 203-205.
56/ Work cited in footnote 10.
57/ Work cited in footnote 10.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The quartz veins from which production has been obtained has averaged from 8 to 8.5 feet throughout the stoped area. The principal ore minerals are galena, sphalerite, and chalcopyrite, together with gold and silver. The gold is sometimes found in the "free" state, whereas the silver may be contained in the sulfides or accompany them as complex silver minerals.

An andesite dike of variable width, ranging between 15 and 20 feet, occupies a position along the vein for a distance of some 5,000 feet. There are a number of prominent dikes of this type throughout the area, some of which may have had an effect upon mineralization. Faults that formed the fissure as well as those which intersected the vein and dike at various angles have localized the mineralization. Some of these faults left gouge, which controlled the course of the mineralizing solutions, and others probably have resulted in the crushed, very soft ore that has been encountered in various areas of the mine.

The Silver Lake property, owned by the American Smelting & Refining Co. and under production by a leasing agreement, is approximately 4,000 feet south of the Shenandoah-Dives vein. The Silver Lake vein and those associated with it are a prominent group and are often referred to as a system. The veins of this system are large and were exposed on the surface for considerable distances, which probably resulted in their early development.

The Silver Lake vein, possibly the more prominent one of the system, strikes northwest-southeast similar to and nearly parallel with the Shenandoah-Dives. Both veins have a northeast dip, but unlike the Shenandoah-Dives which dips at 70° or more steeply, the Silver Lake has a dip of about 50°. This vein also occupies a position adjacent to an andesite or latite dike and has been subjected to faulting from various angles as well as along strike.

The veins to the west of the Silver Lake vein, classed as a part of the system, are designated by both Ransome and Burbank as radial. They suggest that these veins, or at least the fissures they occupy, were formed at the same time as the fissure occupied by the Silver Lake vein. The veins of this group curve away from the Silver Lake vein and assume strikes of nearly north-south direction with steep dips 80° to the northeast. The Melville vein, however, dips westerly at as low as 65° in some parts. The New York to the west and the Stelzner are the principal veins branching from the Silver Lake vein. The Royal branches from the Stelzner, a short distance from the Silver Lake, and maintains a more easterly course than the Stelzner itself.

Both Ransome and Burbank indicate that the East Iowa and Iowa are separate veins occupying fissures approximately parallel to the Stelzner. Mining on the Shenandoah-Dives main level at an altitude of about 11,300 feet, by way of the crosscut completed since the work done by the U. S. Geological Survey geologists, indicates that for all practical purposes they are one and the same vein. The same condition is indicated by work along Royal, Black Diamond, and Melville veins.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Present operations are being carried out on the Silver Lake, Melville, and Iowa veins.

Development and mining. - The terrain is favorable to development by an adit, followed by raising to the upper portions of the mine, a condition common to the mountainous San Juan region. The Main level, also known as the Mayflower level, an adit at an altitude of about 11,200 feet, is about 2,000 feet below the point at which the vein crosses Little Giant Mountain. The selection of a portal site for the adit was contingent upon the snowslide hazard at this property, as in all sections of the San Juan region. At the Shenandoah-Dives, a location in Arrastre Gulch near the base of the precipitous north wall, free from the threat of snowslide, was chosen as the site for the surface installations. This site probably is the only completely safe spot that could serve the needs.

The excellent mill site in the Animas Valley, about 2-1/2 miles northeast from Silverton, is also about 2 miles from and nearly 2,000 feet lower in altitude than the adit level portal. This site is connected with Silverton by an oiled, surfaced State highway, which is well-maintained throughout the year.

Ore is transported from the surface installations to the mill by an aerial tramway. Personnel and supplies are transported from the mill to the mine by this tramway, but heavy equipment is hauled by 4-wheel drive trucks over the steep ground route.

The adit was driven in country rock of the Eureka rhyolite formation from the portal northeastward to its intersection with the vein. The Main level has been extended a short distance to the northwest and about 7,000 feet southeast along the strike of the vein. Mining operations have been carried out from this level by raises and levels driven at 150-foot intervals, as shown on figure 12.

In order to serve the upper workings of the mines, a 1,700-foot raise was driven on coordinate 4,400. Mr. Chase's early experiences at the Liberty Bell mine at Telluride greatly influenced the type of installation. The system of transferring ore, especially the softer material, through long ore passes at that mine failed, and the company was forced to devise a system of lowering it mechanically. At the Shenandoah-Dives, a system of pockets has been excavated below the important currently operated levels, and the ore is lowered by skip. The major factors influencing Chase's decision in the matter were:

1. Hoistmen are required for the transportation of men and supplies to the various operating levels and have time to lower the ore.

2. The ore extracted from any area may be segregated for separate milling or blending for a specific condition.

3. Waste resulting from development may be lowered to a separate pocket.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

4. Movement of the ore is always under observation, and there are no remotely situated throats to watch and maintain.

5. It is helpful in keeping the ore away from trickling water.

The ore is lowered to the top of the storage pocket 300 feet above the Main or Mayflower level.

Development and subsequent mining has produced large tonnages of extremely soft ore, vindicating Chase's judgment.

The practice of driving development drifts to the extremities of the ore bodies and then mining in retreat has been but partially realized at the Shenandoah-Dives mine. The 1,500 and 1,200 levels were driven westerly to the surface and easterly to the old workings on North Star and Dives claims. The 900 level has been driven easterly to a point below the Dives workings, but has not been started west.

In order to operate the American Smelting & Refining property on the Silver Lake vein system, a crosscut about 4,000 feet in length was driven from a favorable Main level location on the Slide claim. This arrangement has permitted extraction and transportation of the ore from the mine to the mill under conditions much more favorable to year-around operation than was previously possible.

The Main level drift, 4,177 feet from the Shenandoah-Dives adit, has been extended to the east some 2,000 feet to a point below the center of the old workings on the Melville vein. A raise driven to a point 550 feet above the Main level is designed to afford access to the unmined upper areas of the Melville vein. From this point it may be continued through old workings to the surface, where it will afford access to large mill and mine dumps. Work in the raise was seriously hampered by water.

A small amount of drifting and stoping has been completed on a vein intersected by the crosscut at a point 3,490 feet from the Shenandoah-Dives vein.

The crosscut intersected the Silver Lake vein at 3,220 feet, and some exploratory work as well as some stoping has been done in the vicinity of the intersection of the vein by the crosscut.

The exploratory and development workings throughout the mine have afforded a base of operations from some 19,000 linear feet of drill-hole (mostly diamond-drill) exploration completed by the company from 1926 through 1947.

The shrinkage-stoping method of mining has been employed for extraction of the ore. The development levels, generally spaced at 150 feet on the dip of the vein, are protected by pillars. The pillars are used not only for support of the wall, but stopes are opened over them almost entirely rather than by "back stoping." After mining has been carried through the levels above, the equipment and facilities are removed, and the ore is drawn from the lower level only.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The chutes used for drawing ore from the stopes have been adapted from Canadian practice and permit a maximum opening of 4.5 feet in width and 3.5 feet in height. An opening of this size allows passage of large rocks with a minimum amount of chute blasting. They are generally spaced at about 25-foot centers between pillars.

Mine haulage. - Storage-battery locomotives were used at the beginning of operations and gave satisfactory service. It is not necessary to maintain trolley wires or track bonds, and units are not dependent on the operation of other equipment. Expansion of operations, together with deterioration of batteries, brought about the change to trolley locomotives. The locomotives are built at the mine shops and weigh about 9 tons. They are powered with two 40-horsepower motors equipped with magnetic-contractor control.

The direct-current generator at 275 volts is powered by a 200-horsepower synchronous motor. This equipment is centrally located, equipped with automatic reclosing circuit-breaker, and serves both the Shenandoah-Dives and Silver Lake mines.

The track installed at the beginning of operations was set at 24-inch gage and was later widened to 30-inch gage. During the earlier operations, cars of 40-cubic-foot capacity were used and were replaced with those of 63-cubic-foot capacity when the track gage was widened. The larger cars on the track of wider gage afford greater stability and are not subject to derailment by the larger pieces of rock that pass through the chutes. The 63-cubic-foot capacity cars are now being replaced by those of 103-cubic-foot capacity on Main level.

Auxiliary installations. - The lack of suitable surface space prompted the underground installation of shops, compressors, and primary crushers, as well as change rooms for the workmen. This installation has been satisfactory and has resulted in considerable saving in expense, heating, and fire insurance.

Compressed air for the operation of mining equipment such as pneumatic drills, hoists, and mucking machines is furnished by one compressor with a capacity of 2,040 cubic feet per minute. The air is distributed through casing by means of Dayton or Dresser couplings, which effects considerable saving in cost and installation. The Shenandoah-Dives trunk line is 8-inch, with 4-inch distribution connections, whereas the Silver Lake workings are served by a 6-inch line. The final air lines of 2-inch diameter are alternately thread or Dayton coupled, and the 1-inch water lines are of standard galvanized pipe. The company has made two separate attempts to use rock chambers for the storage of compressed air, neither of which was successful.

The primary crushing equipment and storage facilities have been installed underground. The coarse-ore pocket under the main-level tracks discharges to a Telsmith 16-A cone crusher, which is followed by a 4-foot Symons cone. The flow of ore to the crushers is controlled by fingers of 90-pound rails. The crushed ore is delivered to the aerial tramway loading bin for transportation to the mill.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The company also maintains and operates a five-story hotel-office building adjacent to the portal of the Main level crosscut. The building is fully insulated, and the kitchen is fully electric.

Sunnyside Mine

This information on the Sunnyside mine was prepared by M. A. Kuryla engineer for the U. S. Smelting, Refining & Mining Co. for inclusion in this report.

History. - The Sunnyside claim, which was the nucleus of the Sunnyside mine (fig. 2), was first worked for gold in 1875. Amalgamation was used to recover the gold until 1896, when the Terry family took active charge and installed a table concentration plant to produce a lead-zinc concentrate. By 1916 a concentrate production of 400 tons per month was attained by means of Wilfley tables and a small flotation and electrostatic plant.

In 1917 the Sunnyside Mining & Milling Co. was organized to acquire and operate the property owned or held by lease and option by the Terry Estate, as well as other property leases. A new 500-ton mill was constructed and began operations in 1918. This mill was the first commercial selective lead-zinc flotation plant in the North American continent, and undoubtedly was a pioneer in the field. In 1928 the mill capacity was increased to 1,000 tons per day. During the period of operation from 1917 to 1938, the mine was shut down twice because of low metal prices.

The 15 productive years accounted for approximately 2,500,000 tons of ore milled with a gross metal value of about $50,000,000. Average mill-head assays were as follows: gold 0.06 ounce and silver 3.5 ounces per ton, lead 4.3 percent, zinc 6.5 percent, and copper 0.4 percent.

The lead and zinc concentrates were shipped to American Smelting & Refining Co. plants for treatment.

The mine has been idle since 1938. In 1948 the property of the Sunnyside Mining & Milling Co. was sold by the Trustee in Bankruptcy, and dismantling of the surface and underground plant was begun.

The low grade of ore, severe winter conditions, present high labor and supply costs, and the large capital outlay required to rehabilitate the property to produce efficiently preclude reopening of the Sunnyside mine in the foreseeable future.

Geology. - The veins at the Sunnyside mine traverse steep glaciated slopes of great relief at elevations of 11,000 to 13,000 feet, crossing from the drainage of Animas Forks into that of Cement Creek. The veins are quartz veins with important quantities of calcite, rhodochrosite, and rhodonite, and minor lead, zinc, copper, and iron sulfides. The sulfides occur mainly within the ore shoots. Rocks cut by the veins are nearly flat-lying, extrusive, volcanic flows believed to be of Tertiary age. The veins are stranded structures between walls of pyroxene andesite and Burns latite,

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

the latter probably extending to below 10,000 feet. Ore shoots within the veins are nearly vertical and average about 20 feet in width. Cross faults offset the veins small distances. The veins themselves appear to be strong and persistent fault structures with considerable displacement. At its greatest developed length, the Washington ore shoot is slightly less than 1,000 feet long, and the longest ore shoot, No Name, is 1,500 feet. The vertical range of the Washington ore shoot was about 1,400 feet when mining was discontinued.

Former operations. - Very hard wall rock and ore made for ideal shrinkage stope mining. Broken ore was hoisted to the surface at the mine, where it was passed through a primary crusher before delivery over a 3-mile aerial tramway line to the mill, which was about 2,000 feet below the elevation of the tramway ore-loading terminal (12,300 feet elevation). Secondary crushing at the mill was followed by primary and secondary grinding in ball and tube mills. Pulp discharge was sent to the flotation circuit, where a lead, zinc, iron, and sometimes a middling concentrate was obtained. The concentrates were filtered and shipped by rail to the smelters. Technical data and detailed description of the Sunnyside flow sheet have been published in several mining journals.

In general, it may be said that there was considerable difficulty every winter from lack of labor, snow conditions, interruptions in the aerial tramway service, and electric-power delivery, in addition to community isolation for weeks at a time. Despite the above operating drawbacks, the Sunnyside Mining & Milling Co. was for many years the dominant mining enterprise in San Juan County as well as the largest active operation of its kind in the State of Colorado.

Pride of the West Mine

The Pride of the West mine is situated in Cunningham Gulch about 7 miles from Silverton, Colo. (fig. 2), or about 2-1/2 miles from the point at which the gulch opens to the Animas River Valley. The settlement in the vicinity of the confluence of the stream from Cunningham Gulch with the Animas River is known as Howardsville. It was the first county seat of San Juan County, and the walls of the first courthouse, a log structure, still stand at the original site.

Cunningham Gulch, a deep, narrow, southeastward-trending valley with precipitous walls, especially on the southern side, exposes a considerable portion of the local formations. A graveled road in good repair traverses this valley and affords access to several mines within the gulch, the Highland Mary mine being situated near its head. The area is one of heavy snowfall, and snowslides often block the road, especially the upper portion, and the Highland Mary mine does not attempt operation during the slide season, generally from the latter part of December to about May 1.

The early history is somewhat obscure, but the Pride of the West mine was in operation when the area was visited by the Hayden survey. It is reported that the mine began shipping ore during 1874, indicating that it is one of the earliest operating mines in the Silverton area.

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

According to Ransome,58/ "the first lot was taken out by pack animals to Del Norte, on the Rio Grande, and there sold in 1874. It was from the upper workings and is said to have contained handsome masses of 'wire silver'."

The property is under the control of Pride of the West, Inc. of Denver, The claims cover the outcrop of the Pride of the West vein, which appears as a hanging-wall vein and a footwall vein separated by 20 feet, more or less, of country rock. Nearly all production has come from the footwall vein. There are other veins of less importance. This company also operated the Green Mountain mine until operations at both mines and at the mill situated at Howardsville were suspended January 10, 1948.

Description of the deposit. - The Pride of the West vein has a general northwest-southeast strike and is nearly vertical in dip. At this particular location, Cunningham Gulch has a nearly north-south trend and the clefts through which the veins pass into the cliffs, forming the east rim of the valley, are recognizable from the roadway by one familiar with conditions. The country rocks of the area are of the Silverton volcanic series of Tertiary age, with Eureka rhyolite, pre-Cambrian schists, and Ouray limestone exposed.59/

The width of the vein varies considerably along the outcrop and the Pride vein reaches a maximum of 30 feet, but throughout the mined area its average width is about 5 feet. The principal ore minerals are galena, sphalerite, minor chalcopyrite, and a variable amount of pyrite in a quartz gangue.

Development and mining. - The Pride of the West vein has been developed by eastward-trending crosscut adits as well as adits or tunnels driven on the vein at various altitudes (figs. 13a and 13b). By this method the vein has been developed laterally for approximately 2,000 feet. The ore shoots were mined by the shrinkage-stoping method between levels. All ore from the levels above the "tunnel level" was transferred to that level by way of an ore pass, or transfer raise, as it was designated. For some unknown reason, the stope above this raise was broken through to the surface and allowed to remain open. During the following winter a snowslide completely filled the empty stope and the raise, which happened to be drawn empty at the time. This blocked access to the productive parts of the mine and most of the 1947 season was consumed in opening it. The snow was packed so hard that it was necessary to "mine" out the 400 feet of the blocked raise, and operations were resumed on the upper levels during the early part of October 1947.

The development planned comprised opening of a stope on an ore shoot about 200 feet in length. During this time ore had been obtained from a "slab" stope. This ore was in the wall of a stope previously thought to have been mined out, and was obtained by slabbing off the wall and drawing it from the chutes installed for the original stoping.

58/ Work cited in footnote 10, p. 169.
59/ Colorado Mining Year Book, 1946, p. 81.

Generated on 2024-09-19 22:05 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 21:55 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

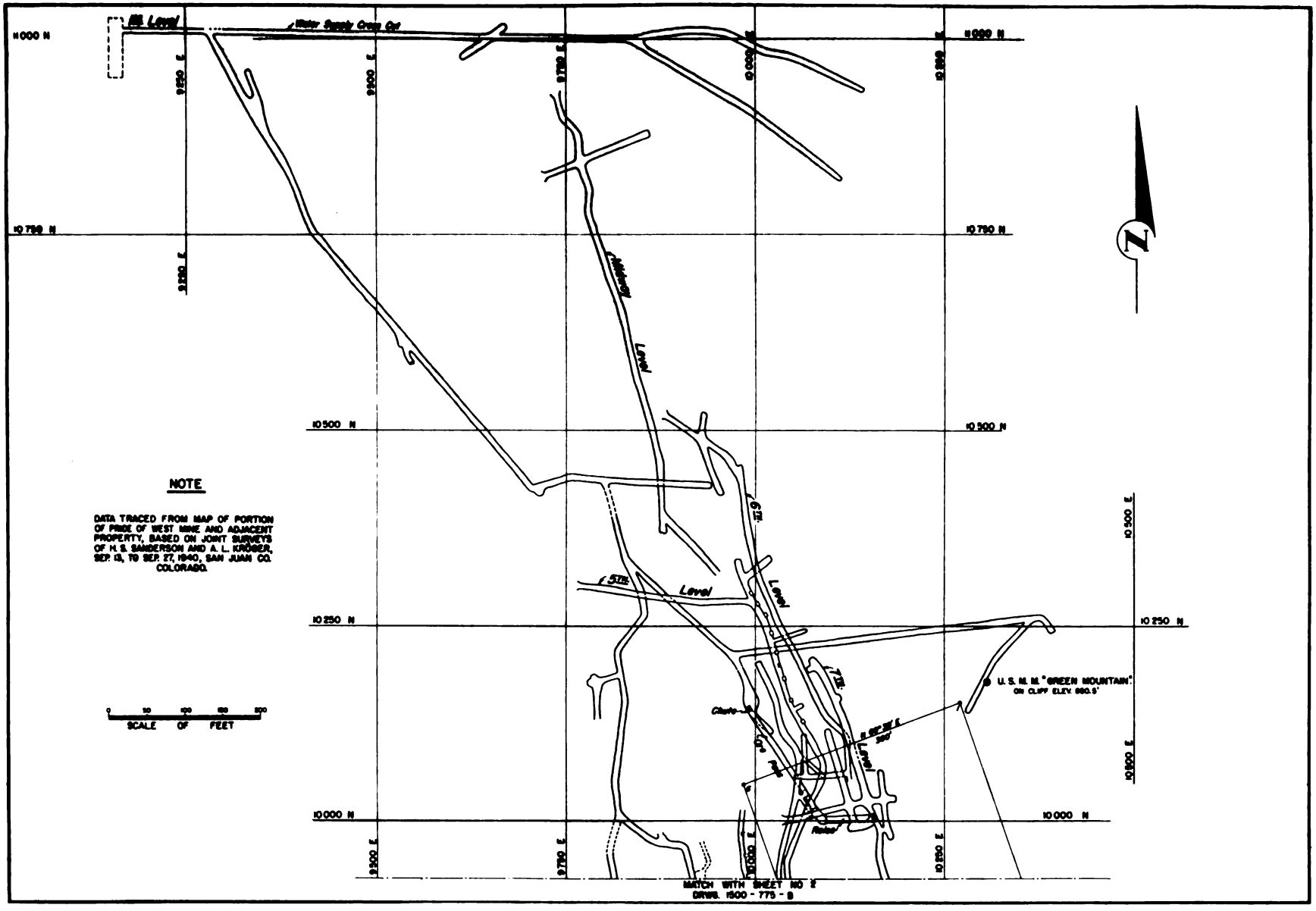
NOTE
DATA TRACED FROM MAP OF PORTION OF PRIDE OF WEST MINE AND ADJACENT PROPERTY, BASED ON JOINT SURVEYS OF H. S. SANDERSON AND A. L. KRÖGER, SEP. 13, TO SEP. 27, 1940, SAN JUAN CO. COLORADO.
SCALE OF FEET
U. S. M. M. "GREEN MOUNTAIN" ON CLIFF ELEV. 660.5'
MATCH WITH SHEET NO 2
DRWG. 1500 - 775 - B

Figure 13a. - Composite plan of level workings, Pride of the West mine (sheet 1 of 2).

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

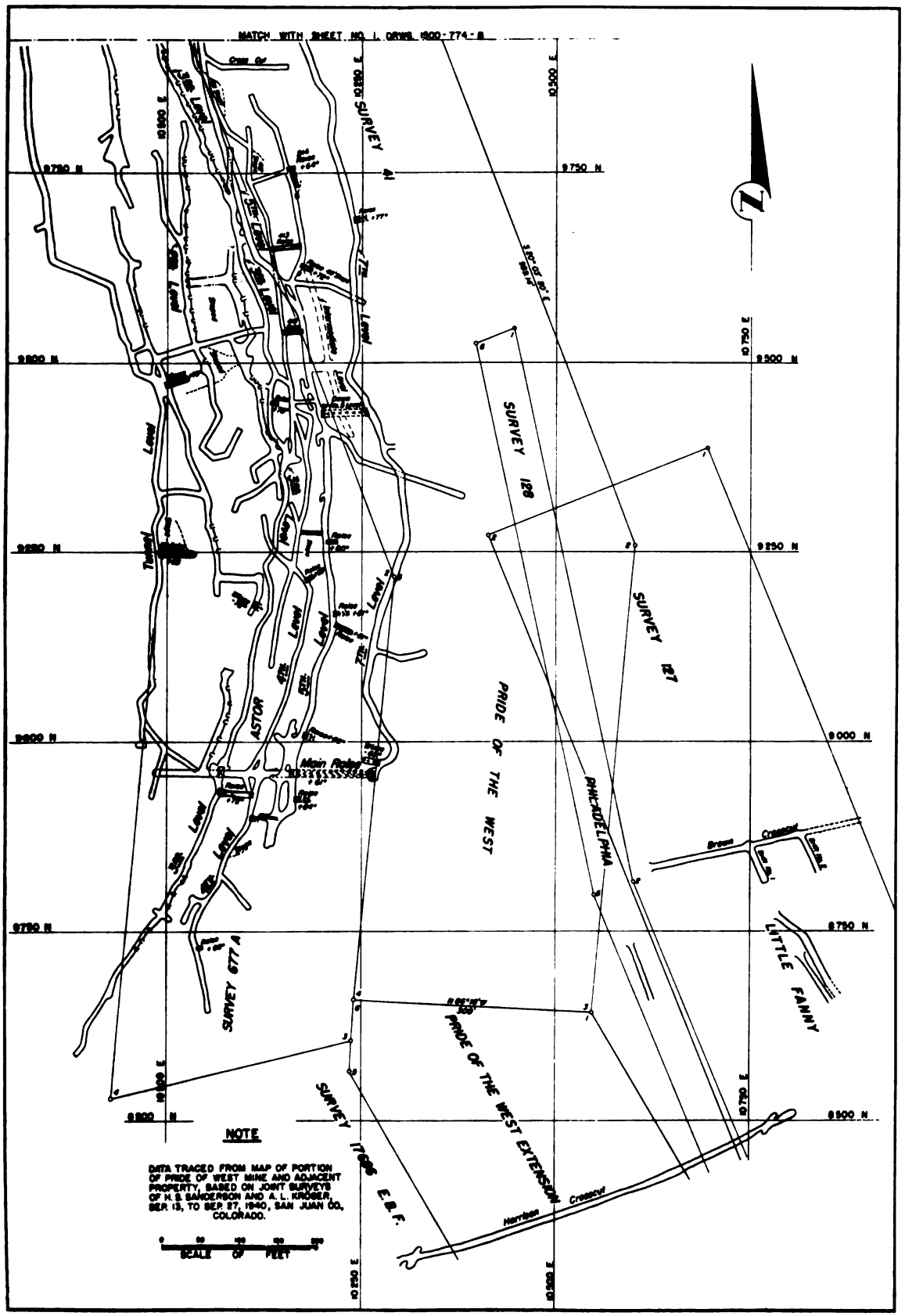
MATCH WITH SHEET NO. 1, DRWG. 1800-774-B
SURVEY 41
SURVEY 128
SURVEY 127
SURVEY 1766
PRIDE OF THE WEST
PRIDE OF THE WEST EXTENSION
ANNEADELPHIA
LITTLE FANNY
ASTOR
Main Parlor
Crosscut
Haulage
NOTE
DATA TRACED FROM MAP OF PORTION OF PRIDE OF WEST MINE AND ADJACENT PROPERTY, BASED ON JOINT SURVEYS OF H. S. SANDERSON AND A. L. KROGER, SEP. 13, TO SEP. 27, 1940, SAN JUAN CO, COLORADO.
SCALE OF FEET

Figure 13b. - Composite plan of level workings, Pride of the West mine (sheet 2 of 2).

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The ore from the hanging-wall workings was transferred to the ore bin at the tunnel level by use of a jig back tram.

The reason given for the suspension of operations January 10, 1948, was that development work had lagged, and consequently the mine was unable to supply the mill with the full tonnage requirements.

The actual mining operations were carried out on a contract basis in most instances. During the latter operations, a price of $10 per foot was paid for drifting, and $12 per foot for driving a 3-compartment raise. The company furnished all equipment and supplies, including compressed air for the operation of drills and air hoists.

Previously, the ore was broken in the stopes on a contract basis. The tramming of ore from stopes to the transfer raise was by hand, whereas on the tunnel level mule tramming was employed.

A Silverton trucking company contracted the transportation of ore from the ore bins to the mill at Howardsville, a distance of about 2-1/2 miles, and the rate averaged $0.50 per ton.

Green Mountain Mine

The Green Mountain mine is on the north slope of Cunningham Gulch, about 8 miles from Silverton, Colo. (fig. 2). The property, owned and operated on a small scale by Pride of the West, Inc., is comprised of five patented claims covering about 4,000 feet of veins nearly parallel to the gulch. The claims were located during the 1870's, and while the historical details are not available, it is reported that a considerable portion of the development work was done during the early 1900's and that a concentrating plant was in operation on the property in 1907. The present operators obtained control of the property during 1936, and have mined out small blocks of ore accessible above the No. 1 tunnel level. A small block of ore was recently extracted below the level. While production records prior to 1936 are not available, it has been estimated by various sources that the mine had produced about 40,000 tons of ore before operations were suspended January 10, 1948.

The Pride of the West, Inc., is a Denver, Colo. organization.

Description of the deposit. - The deposit consists of a fissure vein with a general northwest-southeast strike and a dip of about 70° to the northeast, which becomes steeper just above the No. 1 level. It is known as the Green Mountain vein and is intersected at an approximate angle of 45° by a north-south system of normal step faults. These faults, which are post-mineral, dip 60° west and in each case the west segment of the vein has been displaced downward and 15 to 25 feet to the south. The aggregate downward displacement is 300 to 400 feet, and, therefore, the ore exposed on a given level is geologically higher on the downthrow or west side of the faults.

Generated on 2024-09-19 21:55 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The principal sulfide minerals in the ore are galena, sphalerite, chalcopyrite, and pyrite in a gangue of quartz and altered country rock. The portion of the vein under exploitation is situated at the northern end of the outcropping of the pre-Cambrian schists. It crosses the schistosity at nearly right angles and is "frozen" to the fissure walls. It varies in width, as all veins of this type, and probably averaged 5 feet through the ore-bearing zones.

Development and mining.- The mine is developed by four adits or tunnels driven on the vein. The details of these levels are shown in figure 14, and the general information follows:

Level	Altitude, feet	Length, feet
No. 1	10,300	960
No. 2	10,408	865
No. 3	10,541	410
No. 4	10,705	200

Levels 1, 2, and 3 are connected by numerous raises, and a stope extends from No. 3 to No. 4 level. The zones of sufficient mineralization to be classed as ore have been stoped between each of the levels. The No. 1 and No. 2 levels were maintained in operating condition, but the upper portion of the mine was allowed to deteriorate.

The winze below No. 1 level was sunk for the purpose of exploration and extraction of the downward extension of a shoot of ore mined above the level. This winze was sunk to the depth of about 170 feet on the dip of the vein, which is 78° at this location.

The station was cut at the depth of about 145 feet; the remainder of the distance was used for a sump and skip-loading facilities.

The drift from this station was driven southeasterly along the vein a distance of about 250 feet, but was only extended to the northwest about 50 or 60 feet.

All stoping was by the shrinkage method, which proved satisfactory. There is no gouge, and the vein is "frozen" to the wall causing difficulty in breaking it clean. The ore was drawn from the stope before operations were suspended and the workings below the No. 1 level will be flooded.

The compressed air for operation of mining equipment was supplied by two electric-motor driven, semiportable compressors of 250 cubic feet per minute capacity each. Two heavy, self-rotating, stoper drills were used in breaking the ore in the stope, whereas drift rounds were drilled by column-mounted drifting machines. Detachable bits were used on both drifter and stoper drill steel, round steel being used by the drifters and 1-inch quarter octagon by the stopers.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Rock broken in driving drifts was loaded by a mucking machine into end-dump mine cars. Loaded cars were trammed on the winze level by hand, but on the No. 1 level, mule haulage was employed.

Hoisting equipment at the winze was electrified, the power transmitted by a 3-conductor armored cable.

A diamond-drill exploration program had been underway with a company-owned drill.

All possible divisions of the mining operations are done on a contract basis. The last drifting was contracted for at the rate of $12 per foot and 3-compartment raises at the rate of $14 per foot, the company furnishing all equipment and supplies. In general, the ore was also broken on a contract basis, but such a contract was not in effect during the latter part of 1947.

Ore was transported from the mine to the Pride of the West, Inc., mill at Howardsville, about 3 miles distant, by a Silverton trucking company. During the past season, the average rate for transportation was $0.50 per ton.

Treasure Mountain Gold Mining Co.

The Treasure Mountain Gold Mining Co. property is situated on Treasure Mountain, approximately 12 miles north of Silverton, Colo. (fig. 2). Treasure Mountain is within the Eureka-Animas Fork area to the south of the Mineral Point district and slightly west of north of the Sunnyside camp at Eureka. Geologically, the area is known as the northeast border zone of the Silverton caldera.

The property is comprised of some 30 patented claims together with a few unpatented and partly owned claims. These claims cover the outcrops of several prominent veins, among them the well-known formerly high-grade gold producers exploited by the Golden Fleece, Scotia, and San Juan Queen mines. These mines were important producers of gold ore between the years 1875 and 1900. They did not produce a sufficient amount of the base metal ores to warrant their inclusion in records of such metals.

During the period of activation of the access roads program, a road was constructed from the county road in Animas River Canyon to a point in Picayune Gulch, about one-fourth mile from the mine. This road gave access to other properties, but was extended to the camp site at the portal of the Santiago tunnel by the present owners.

Guy L. V. Emerson, 501 Midland Savings Building, Denver, Colo., is president of the company, and E. R. Abadie, Silverton, Colo., directs the operations.

Description of the deposit. - The Treasure Mountain property is crossed by two sets of veins intersecting the country rock composed of flows of the Silverton volcanic series. The northeasterly trending set approximates

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

in strike the veins of the Mineral Point district to the north. The northwesterly set intersects these veins at angles ranging from 10° to 30°. Dips as low as 61° and measurements up to 125 feet in width have been reported. The veins are similar in character to other vein-type deposits in the area; that is, they comprise principally quartz, appreciable amounts of which are porous or vuggy at this particular location. The veins have been further mineralized with disseminated, fine-textured galena. A considerable amount of rhodonite is localized at various places throughout the length of the veins. According to reports, the veins were productive principally of gold-bearing ores, and there are indications that these ores were of a higher grade in the proximity of the zones of rhodonite.

Mill settlement sheets covering the purchase of gold ores from the Golden Fleece, Scotia, and San Juan Queen claims show some lead and zinc, but the content of these metals is generally less than 1 percent each. Concentrate shipments derived from gold ores milled on the property contained up to 3.85 percent lead and a maximum of 3.4 percent zinc.

Development and mining. - During the early days of mining, the veins were developed by shafts and drifts, the stopes being opened above the drifts. These old workings have not been accessible for a considerable length of time, and information is from reports, former employees, and local inhabitants. There is reported to be 500 feet of drifting and some stoping at the San Juan Queen mine, and 1,200 feet of drifting with a considerable amount of stoping at the Scotia and Golden Fleece mines.

Efforts of the more recent operators have been concentrated on driving the Santiago tunnel, an adit designed to intersect the productive zones of the Golden Fleece vein at a considerable distance below previous workings. The portal of this tunnel is at an altitude of approximately 11,630 feet on the north side of Picayune Gulch. It has been driven northwesterly a distance of about 1,600 feet to its intersection with the Scotia vein, which strikes northeasterly and is inclined toward the southeast at 70°. A drift was then driven to the southwest about 600 feet, but the exposed portion of the vein was apparently not of sufficient grade to warrant further exploration. The crosscut was then continued northwesterly toward the Golden Fleece vein, a distance of about 650 feet. At this point it was considered advisable to precede further work of this nature by diamond-drill exploration. Diamond-drill hole 1, directed about N. 45° W. and nearly horizontal, intersected the Golden Fleece vein, and a large flow of water under considerable pressure was encountered from 148 to 162 feet from the face of the crosscut. It was necessary to use a mucking machine to force the drill rods into the hole because of the high-water pressure, which could result from the difference in elevation between the water level at the old Golden Fleece workings and the point of intersection by the drill hole.

Other holes drilled easterly from the main adit intersected a vein that appeared to be almost parallel to the adit itself. To further explore this vein, a crosscut was in progress in that direction at the time suspension of 1947 operations was necessary because of heavy snowfall.

Generated on 2024-09-19 22:04 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

When the crosscut has been completed to the Golden Fleece vein, it will have a distance of 3,140 feet from the portal. It will be driven along the course of the drill hole and should attain the objective during July of 1948.

The rounds were drilled in the face of the crosscut by use of two column-mounted drifting machines. The broken rock was loaded into end-dump cars by a mucking machine. The cars were trammed to the surface by a mule. Because of inability to obtain a suitable electric trammer, a compressed air-powered locomotive was constructed at Silverton. This locomotive is equipped with a 10-horsepower, 5-cylinder, radial-type mucking-machine motor. The tank or receiver for the compressed air is 8 by 3 feet and, together with the motor, is mounted on a channel-iron frame. This frame is so constructed that it will not permit it to drop completely to the track in case it becomes derailed. The truck has 14-inch wheels and 2-inch axles, fitted with completely sealed, Alemite-greased, double-race ball bearings. The power is transmitted from the motor to the axle by a roller chain, which is protected by a channel iron that also aids lubrication. The locomotive is perfectly balanced when an operator weighing 175 pounds is at the controls. It has an over-all length of 10 feet and a height of 4-1/2 feet.

This equipment was constructed under the direction of E. R. Abadie, superintendent, and was placed in service when operations were resumed early in June 1948. It handles five 1-ton cars very satisfactorily and has created considerable interest, especially among the smaller operators, who have employed either horse or mule tramming at their operations.

Company operations during the past season consisted only in drifting, which was done on a contract basis. The company furnished all supplies and equipment and paid the three employees $14 per foot for the work. The company employed one man to operate the compressor, sharpen picks, and attend the other surface needs.

Lead Carbonate Mine

The Lead Carbonate mine is about 1-1/2 miles northeast of Gladstone (fig. 2), the present terminus of the county road traversing the narrow valley of Cement Creek.

Gladstone was formerly connected with Silverton by a narrow-gage railroad which served the mills and mines of the area as well as the town, which was reported to have had a population of several hundred at one time. With the decline of mining caused by the demonetization of silver, operation of the mills was suspended resulting in abandonment of the town and railroad. A few dwellings remain, some of which might still be made habitable in case it was considered desirable.

The Lead Carbonate mill, recently constructed and placed in operation during October 1947, is at the eastern edge of the dump of the old Gold King mine at Gladstone. It was considered advisable to construct the mill at this location rather than risk damage by snowslides, which demolished the old mill adjacent to the mine. A truck trail from Gladstone to the Lead

Generated on 2024-09-19 22:05 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Carbonate mine was constructed by a Government agency during the life of the access roads program, and permits transportation of equipment and supplies to the mine.

The property was prospected during the early days of the district, and there is evidence of some production, but the records are no longer available. Recent development was performed by Vaughan Jones, of Silverton, who obtained control of the property and a Reconstruction Finance Corporation loan to finance the work. He succeeded in exposing minerals of sufficient value to interest the present operators, who purchased the property July 1, 1946. The partnership, composed of Henry P. Ehrlinger and John and Fred Archibald of Silverton, Colo., operated the property during the balance of 1946 and through 1947 but have begun incorporation proceedings to be effected February 1, 1948. During the period of operation by the partnership, the mine was completely equipped and the mill was constructed and placed in operation in addition to retiring the R.F.C. loan and substantially reducing the original indebtedness.

It is reported that during 1947, prior to the time the mill was placed in operation, 6,248 dry tons of ore was trucked to Silverton and shipped to the U. S. Smelting, Refining & Mining Co. custom mill at Midvale, Utah. It is also reported that the average grade of this ore was 6.05 percent lead, 5.9 percent zinc, 1.03 percent copper, 9.7 ounces silver, and 0.79 ounce gold per ton.60/

Description of the deposit. - The name Lead Carbonate, as applied to this mine, is misleading. The deposit is comprised of a quartz vein further mineralized with galena, sphalerite, pyrite, and some chalcopyrite. There is no indication of lead carbonate minerals in the present workings. Some of the early prospectors may have found some oxidized surface material, which they assumed to be of that character, and consequently gave the vein that name. This vein has a general northeast-southwest strike and dips northerly at an angle of about 50°, comparable to the "flat" veins of the Telluride district. The Mocking Bird vein, striking northeasterly and much steeper in dip, intersects the Lead Carbonate vein at a point about 125 feet east of the crosscut adit. The Mocking Bird vein occupies a fissure younger than that of the Lead Carbonate and has displaced it horizontally about 60 feet. This vein is also composed principally of quartz containing sulfides of lead, zinc, and copper, together with some gold and silver. Appreciable amounts of rhodonite occur sporadically throughout the vein, a condition common at the nearby Sunnyside mine.

Both veins vary in width, as is common to this type of deposit. There has not been sufficient stoping to permit a definite statement as to the width of the ore-bearing zones; however, it is estimated that widths of 5 to 6 feet will be mined.

The country rocks of this area are andesites of the Silverton volcanic series.

60/ The Nineteen Forty-Eight Mining Year Book, Colorado Mining Association, pp. 114-115.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Assays of mill-head samples have varied somewhat, depending on mining conditions. One such sample indicated a content of 4.25 percent lead, 4.65 percent zinc, 0.50 percent copper, 0.038 ounce gold, and 5.36 ounces silver per ton. The Bureau of Mines report approving the construction of the access road gave an average analysis of their samples as 7.8 percent lead, 8.3 percent zinc, 0.9 percent copper, with 0.04 ounce gold and 5.71 ounces silver per ton.

Development and mining.- Access to the vein is by a crosscut adit driven in a northwest direction about 800 feet at an altitude of 11,600 feet. Drifts have been driven both northeasterly and southwesterly along the Lead Carbonate vein, and in both directions along the Mocking Bird vein from its intersection with the Lead Carbonate vein, about 125 feet east of the crosscut.

Earlier operators sank a winze and drove some drifts below the tunnel level, but these workings have not yet been rehabilitated by the present owners.

Although the Lead Carbonate is not as steep as most of the veins in the Silverton district, both it and the Mocking Bird veins are mined by the shrinkage-stoping method.

An appreciable amount of ore, which was too low in grade to permit economical extraction before the mill was placed in operation, was left unmined on the walls of the stopes. Since the ore has been concentrated at the company mill, some of these lower-grade ores have been mined and treated.

Since the present organization purchased the property, they have fully equipped the mine with the late-model air drills, a mucking machine, and an adequate supply of small tools. A quonset type of building shelters the shop and a Chicago pneumatic compressor. It is very satisfactory and affords ample shelter for all present needs. Snow sheds cover the track as well as the ore bin, which has a capacity of about 150 tons, or enough ore for 3 days of mill operation.

Mule haulage and end-dump mine cars are used for tramming the ore from the mine to the ore bin. The ore is hauled from the mine to the mill by trucks, dumped on a grizzly, and the large pieces are broken with a hammer before being allowed to drop through into the crusher bin.

All mining is on a contract basis, one contract covering the entire operation. The contractors agree to drive 150 feet of development heading per month, as may be directed by the company. They receive 15 percent of the net smelter returns after payment of all royalties and other costs. The company furnishes all supplies.

A local trucking company contracts for the transportation of the ore from the mine to the mill at the rate of $0.75 per ton. This same company hauls supplies to the mill and mine on the back haul at $0.50 per ton, and loads the concentrates on the car at Silverton at a rate of $1.25 per ton.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Highland Mary Mine

The Highland Mary mine is in Cunningham Gulch about 8-1/2 or 9 miles from Silverton, Colo. (fig. 2). It is reported to have produced high-grade shipping ore during the early 1900's, and was not operated again until the present organization obtained control of the property.

Albert R. Jones, 900 Land Bank Building, Kansas City, Mo., is president of Highland Mary Mines, Inc., and Fred A. Brinker, Durango, Colo., is general manager. R. M. Andreatta is superintendent, Wm. Loftus, mine forman, Carl A. Larson, chief Clerk, and the local offices are in Silverton.

An excellent description of the operation may be found in Mining World, vol. VIII, No. 2, February 1946, pp. 19-22, or The Nineteen Forty-Six Mining Year Book, pp. 83-84, published by The Colorado Mining Association, State Office Building, Denver, Colo.

Description of the deposit. - Production is from a vein which strikes about N. 45° W. and has a slight inclination to the northeast. The vein filling comprises principally quartz and some calcite, further mineralized with galena, chalcopyrite, and pyrite, together with some sphalerite, tetrahedrite, and free gold. To the northwest it is under production by the Shenandoah-Dives Mining Co.

The erosion that formed Cunningham Gulch has exposed the geologic formations on the precipitous canyon walls. The oldest exposed rocks are the Archean schist overlain by a block of andesite, which, in turn, is covered by a rhyolite flow and capped by latite. The approximate extent of the igneous rocks is illustrated in figure 15. The rhyolite and latite are probably of the Silverton volcanic series, but available information does not indicate the origin of the andesite or its extent. The schist is a member of the basement rocks and is of pre-Cambrian age.

The Spar fault displaces the vein and has apparently controlled mineralization to a notable extent. The silver content of the ore is higher to the south of the fault, whereas to the north the silver content is lower and the gold is higher. The position of this fault is also illustrated in figure 14.

This vein, like others of that type, has a tendency to pinch or swell to a certain extent, but throughout the ore zone it has averaged about 6 feet in width.

The ore extracted during 1947 contained 0.1 ounce gold and 4.81 ounces silver per ton, with 1.32 percent lead and 0.16 percent copper.61/

Development and mining. - Access to the mine is gained by the Bradley crosscut, the portal of which is at an altitude of 11,352 feet, about 1,000 feet above the floor of the valley at the mill site. The crosscut intersects the vein and old workings at a point about 900 feet from the portal. The

61/ Personal communication, Fred A. Brinker to P. T. Allsman, March 5, 1948.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

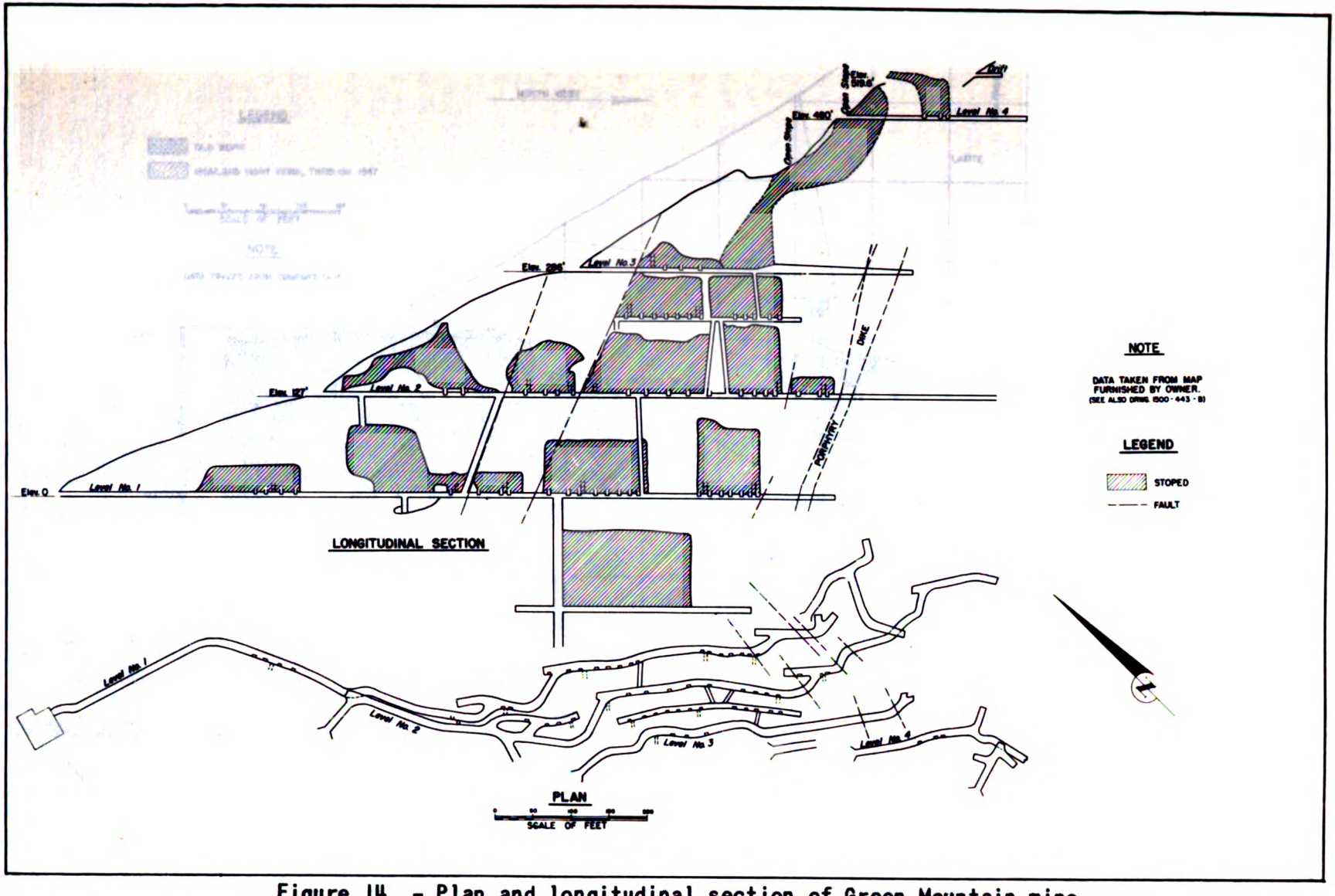

Figure 14. - Plan and longitudinal section of Green Mountain mine.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

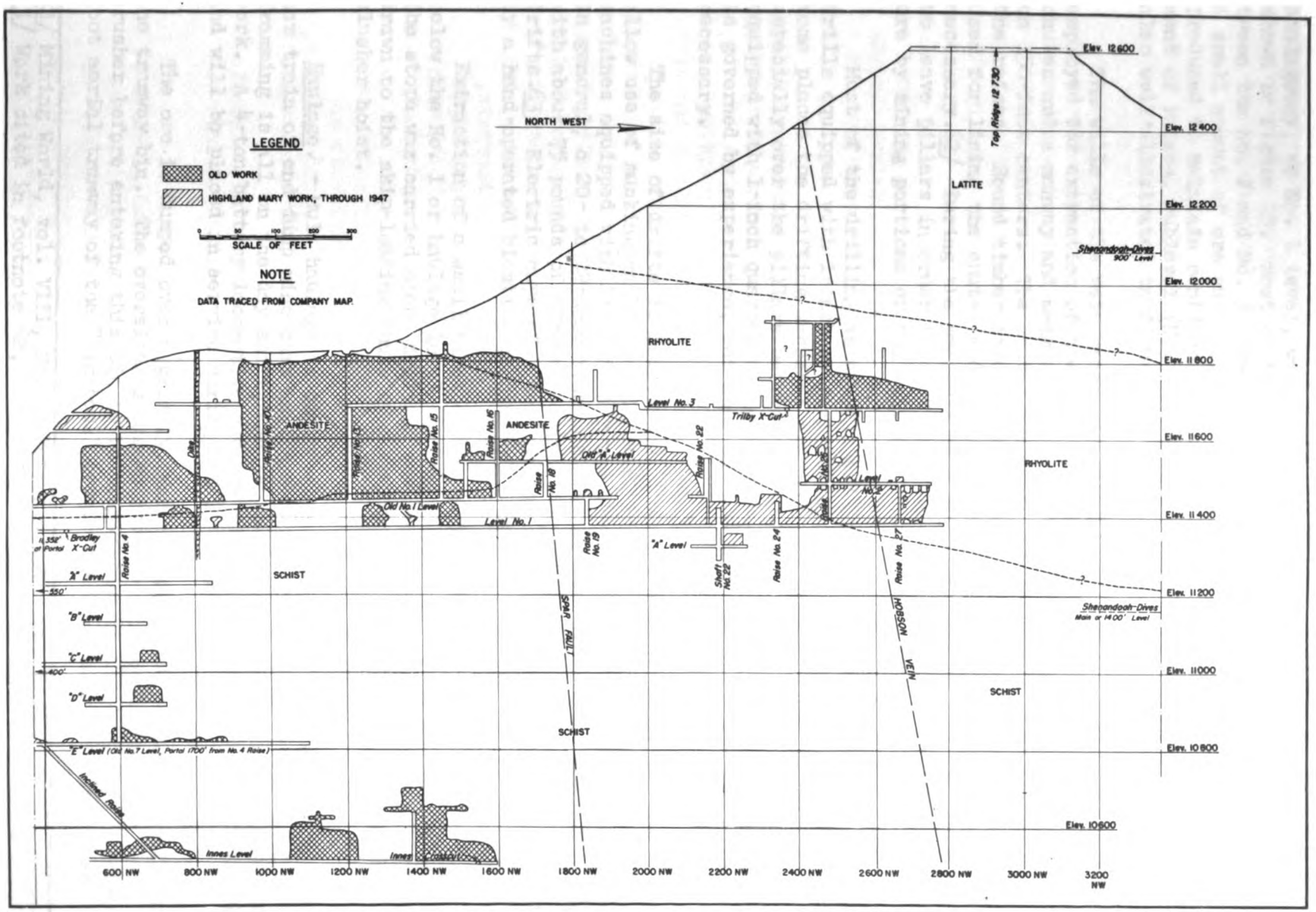

Figure 15. - Longitudinal section of Highland Mary mine.

Digitized by Google
Original from THE OHIO STATE UNIVERSITY

haulageway, or No. 1 level, was driven along the strike of the vein, as shown in figure 15. Most of the 1947 production was mined from a block between the No. 2 and No. 3 levels immediately below the old Trilby workings. A small amount of ore was obtained from No. 22 shaft. Enough ore was produced to maintain continuous operation of the 100-ton mill. The arrangement of raises, sublevel (No. 2 level), pillars, and extent of mining are also well-illustrated in figure 15.

The walls of the vein generally stand well, and shrinkage stoping is employed for extraction of the ore. Development raises consisting of two chutes and a manway and measuring 7 by 18 feet are driven in the vein and on 150-foot centers. The chutes are installed on 25-foot centers between the raises. Round timber is used for stulls, and 3- by 12-inch planks are used for lining the chutes and manways. Very little other timber is necessary.62/ During the progress of a stope it is occasionally advisable to leave pillars in order to hold the wall or to eliminate dilution of the ore by mining portions of the vein that may be too low in grade.

Most of the drilling in stopes is done with the heavier rotating stoper drills equipped with 1-inch quarter-octagon steel and detachable bits. In some places the drifting machines are used for advancing the stopes, especially over the pillars between the chutes. These machines are also equipped with 1-inch quarter-octagon steel. The burden placed on the holes is governed by experience, but some block holing and chute blasting is necessary.

The size of drifts is maintained at 7 by 7 feet in cross section to allow use of mucking machines and power haulage. Column-mounted drifting machines equipped with 1-1/8-inch round steel are used in driving the drifts. In general, a 20- to 22-hole round drilled to the depth of 6 feet and loaded with about 75 pounds of 40-percent gelatin powder is used in advancing the drifts.63/ Electric caps of 0 to 7 delays are used, and the round is detonated by a hand-operated blasting machine of 50-hole capacity.

Extraction of a small block of ore to the north of No. 22 shaft and below the No. 1 or haulage level has been in progress during the past season. The stope was carried open, drilling was from stulls, and the broken ore was drawn to the skip-loading chute by a double drum, compressed air-powered slusher hoist.

Haulage. - Mule haulage is employed at present. A mule handles a five-car train of end-dump mine cars having a capacity of 20 cubic feet each. Tramming is all on the day shift, and two mules are required to complete the work. A 4-ton battery locomotive and the necessary accessories are on hand and will be placed in service during the 1948 season.

The ore is dumped over a grizzly, and the undersize passes directly to the tramway bin. The oversize is passed through a 9- by 16-inch jaw crusher before entering this bin to be transported to the mill by a 1,200-foot aerial tramway of the "jig-back" type. The buckets of 12-cubic foot

62/ Mining World, vol. VIII, No. 2, February 1946, pp. 19-22.
63/ Work cited in footnote 62.

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

or 1,300-pound capacity operate in counterbalance, and about 2 minutes is required per trip. This tramway is also used for the transportation of all personnel and supplies to the mine.

Power. - The area is one of heavy snowfall, and slides block the road throughout the winter, so that the operating season generally begins during April and may last through most of December. Higher power costs result from this condition, because it does not permit year-round line load. The slides also destroyed the power line each winter, until what is believed to be a unique transmission line was constructed. Three cables were strung across Cunningham Gulch from points above the slide-forming areas. The three-wire transmission line is suspended high above the valley floor by these cables, and the arrangement has eliminated power difficulties from that source.

The installation of a hydroelectric power plant consisting of a 250-horsepower, 3-phase, 60-cycle synchronous motor driven by a 36-inch, single nozzle Pelton wheel, equipped with a Woodward governor, delivers power at 440 volts.64/

Water is taken from Highland Mary Lake, some 7,000 feet distant, and delivered to the Pelton wheel under a head of 832 feet. Another 36-inch Pelton wheel furnishes power for the operation of a 400-cubic-foot compressor, which, together with a 335-cubic-foot electrically driven compressor, supplies compressed air for use at the mine as well as the mill.

Garry Owen

The Garry Owen lease has also been known locally as the Sterling lease (fig. 2), and is comprised of six claims leased from the Old Hundred Gold Mining Co. and five claims obtained from San Juan County by purchase of tax title. The Sterling claim, one of the group, is an old location, its patent number being 708. This property is situated on Galena Mountain, and access is by way of Galena Creek. The mountain is a very prominent and precipitous peak rising to an altitude approaching 13,000 feet, with some parts probably above that altitude. The western slope is drained by Porcupine Gulch, whereas Maggie Gulch is on the northern side. Galena Creek and the site of operations is reached from the Cunningham Gulch side by a primitive road traversing Rocky Gulch. The area is difficult of access, and operations are confined to the season between May and November, which, of course, varies somewhat with the prevailing weather conditions.

The Old Hundred Co.'s mill is situated in Cunningham Gulch, a short distance from its mouth, but has not been operated for several years and is in very poor condition.

Description of the deposit. - Galena Mountain is composed of rocks of the Silverton volcanic series that have been intruded by monzonite. The intrusives appear to have affected mineralization and, in the vicinity of the monzonite, the deposit is the siliceous, gold-bearing, pyritic type with

64/ Work cited in footnote 62.

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

smaller amounts of lead and zinc than are generally common throughout the district. To the north and east the deposit again assumes the character general throughout the district.

Galena Mountain is traversed by numerous veins that vary in width as well as in length. This vein system is composed of quartz veins with strikes ranging from northeast-southwest through north-south and northwest-southeast. Current operators are carrying out development on the Sterling vein system. The lessee reported that a composite assay of 11 samples taken from the 4-foot vein on the Garry Owen tunnel level indicated a content of 10.1 percent lead, 3.3 percent zinc, 0.38 percent copper, 2.23 ounces silver, and 0.03 ounce gold per ton. From the Sterling tunnel level, 437 feet above the Garry Owen, eight samples with an average width of 4.4 feet indicate a content of 13.3 percent lead, 3.5 percent zinc, 0.1 percent copper, 4.4 ounces silver, and 0.06 ounce gold per ton.65/

Most of the ore shipped during 1947 was from preparatory work. The assay of samples from 56.34 tons shipped during August was 3.55 percent lead, 3.5 percent zinc, 0.45 percent copper, 1.925 ounces silver, and 0.0185 ounce gold per ton.

Samples from 49.905 tons shipped during November 1947 assayed 8.5 percent lead, 2.975 percent zinc, 0.16 percent copper, 1.7 ounces silver, and 0.028 ounce gold per ton. Both of the above lots were shipped to the Shenandoah-Dives mill near Silverton.

Samples from 65 tons shipped to the American Zinc, Lead & Smelting Co. treatment plant at Ouray during October assayed 8.66 percent lead, 3.21 percent zinc, 0.275 percent copper, with 1.915 ounces silver and 0.021 ounce gold per ton. The inability of the Shenandoah-Dives plant to accept the custom ore during that period necessitated the extra transportation cost. According to H. A. Ruether, ore found during the latter part of the 1947 season improved in grade.

Development and mining. - The Garry Owen tunnel level is the main haulageway, and the next level, 437 feet higher is known as the Sterling tunnel.

The lessee has rehabilitated the Garry Owen level and the storage bin of 140 tons capacity. A ventilation raise has been started, and some stope preparation has been completed. This work will be continued during the 1948 season, and production probably will be stabilized.

The operator does not have a crusher at the mine, and the ore is shipped "mine run" to the mill. The lessee reports that about 500 tons of ore had been shipped to the Shenandoah-Dives treatment plant during the 1947 season.

65/ Personal communication.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Osceola Mine

The principal surface installations of the Osceola mine, also known as the New Green Mountain mine (fig. 2), are a short distance north of the Pride of the West mine. The Pride of the West installations are above the road, whereas the Osceola is below it and connected with it by a short private branch. The property is owned by a partnership; the members are W. G. Gianetto, L. C. Shirk, and C. L. Larson, all of Silverton, Colo. They have 15 patented claims, 1 patented mill site, and a patented placer claim.

The property was mentioned by Ransome,66/ who states: "North of the Pride of the West is a lode running generally parallel to the road. There are several prospects on it, but it has never produced pay ore." He also mentions the occurrence of "a very curious banded ore" found on one of the dumps. He shows an illustration on Plate XII, opposite page 88, and on page 89 gives the following description:

> Remarkably fine and regular banding was observed in the ore thrown out on the dump of a small deserted tunnel on what is probably the Osceola claim, in Cunningham Gulch, about half a mile above Stony Gulch. In its most perfect form, this banding consists of dark sheets of finely crystalline sphalerite and galena about one-half millimeter in thickness, separated by plates of vitreous quartz about 2 millimeters in thickness. The result is a remarkably regular and striking fine banding.
>
> The little sheets of quartz frequently show comb structure and have apparently crystallized in open spaces. In some facies with rather wider banding, chalcopyrite occurs, chiefly in the quartz ore bands. The cause of such fine and regular banding is not known, but is probably connected with metasomatic replacement. The ore is apparently of too low grade for profitable working and was not seen in place.

Subsequent to Ransome's visit to the district, the Lawrence crosscut adit was driven eastward and intersected the Osceola vein about 600 feet from the portal.

Description of the deposit. - Locally there appears to be some speculation as to the possibility that the vein being developed at the Osceola property is the extension of the Pride of the West. Until contemplated surveys have been completed, it will be assumed there is no conflict and that the vein under consideration is the one mentioned by Ransome. It has a nearly north-south strike and an approximately vertical dip. Like other veins intersecting the volcanics of the Silverton series, it comprises principally quartz further mineralized with galena, sphalerite, some chalcopyrite, and variable amounts of pyrite. Some of these minerals contain small amounts of silver and gold. About 1,000 tons of ore extracted from the Osceola vein through the March crosscut averaged about 5 percent

66/ Work cited in footnote 10.

Generated on 2024-09-19 22:06 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

lead, 7 percent zinc, 0.65 percent copper, 1.5 ounces silver, and 0.02 ounce gold per ton.

This group reported that they shipped about 1,600 tons of ore broken by previous operators and left on the tracks of the lower or Lawrence adit level, probably during 1907. They also shipped about 1,300 tons, which they mined from the vein to the south of the Lawrence adit intersection. They reported that the total tonnage averaged about 3.5 percent lead, 2.8 percent zinc, 0.84 percent copper, and contained 2.7 ounces silver, and 0.025 ounce gold per ton.

Throughout the area mined by previous operators (1903 to 1907) and the current operations, the vein averaged about 8 feet in width.

Under conditions prevailing during 1947, ores of this grade did not permit economical extraction without the premium advantage. The suspension of premium payments is probably the cause of cessation of operations during the latter part of 1947.

Development and mining. - The principal workings of the Osceola mine comprise the lower or Lawrence crosscut adit and the drifts on the veins intersected by it. The adit, driven on an easterly course, intersected the Osceola vein at a point about 600 feet from the portal. It also intersected other veins farther east, but little or no work had been done on them by the early operators, and the present operators have not rehabilitated these workings.

The drift on the Osceola vein had been driven both north and south from the crosscut, and the vein had been stoped to about 70 feet above the level on both sides of the crosscut. The early operators left broken ore on the drift level to the north of the crosscut, which the partners cleaned up and shipped. To the south of the crosscut, the present operators installed timber, lagging, and chutes sufficiently close to the back of the old stope to permit resumption of stoping by the shrinkage method. Below this timber they installed stulls and track to permit drawing the chutes and tramming the broken ore to the transfer chute for lowering it to the tunnel level. The block of ground above this level is about 400 feet in height and would produce considerable ore.

The March crosscut has been rehabilitated, and some ore was extracted through it, but operations at this point were suspended in favor of the work undertaken on the Lawrence adit level.

The mine is well-equipped mechanically, considering the type of operation. Compressed air for the operation of drills, hoists, and other air-operated equipment is furnished by a 285 cubic foot-capacity, gasoline motor-driven compressor. The stoper drills in use are of the heavy self-rotating type. The column-mounted drifting machines also are of the latest type. Detachable bits are used in all drilling. Mule haulage was employed on the Lawrence level.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

All the partners engaged in this venture are experienced miners and handle the complete operations without employing additional help.

Ore is transported from the mine to the treatment plants by a trucking company in Silverton. The rate for transporting the ore from the mine to the Shenandoah-Dives mill near Silverton was $0.82 per ton and to the American Zinc, Lead & Smelting Co. mill at Ouray the rate was $4.80 per ton.

Great Eastern Mine

The Great Eastern Mining Co., W. L. Chase, superintendent, Silverton, Colo., has obtained control of several properties in Burns Gulch (fig. 2). This is a rather high, eastward-trending valley that opens into the Animas River Canyon about 10 miles northeast of Silverton. During the life of the mine-access road program, about 2 miles of access road was constructed to serve the mines of this area. The Great Eastern and Silver Wing mines, now controlled by the Great Eastern Mining Co., together with the Tom Moore, Frederika, and Klondyke mines, were considered to be of sufficient merit to warrant construction of the road.

The Great Eastern Mining Co. began operations during June 1947 by construction of a new road and repair of existing roads or truck trails to permit delivery of supplies to the portal of the lower adit on the Great Eastern vein. As the mine had not been in operation for a long time, complete rehabilitation of the workings was necessary.

The Silver Wing property was in about the same physical condition when taken over. Ransome[67] mentions the Silver Wing and Tom Moore properties; however, he does not mention either the Great Eastern or Klondyke mines, and it is assumed that these veins had not been prospected at that time.

Description of the deposit. - The Great Eastern vein, comprised principally of quartz and an appreciable amount of talc, also contains galena, sphalerite, and pyrite, small amounts of chalcopyrite, tetrahedrite, and bornite, and a variable amount of silver. The vein has a generally northeasterly trend and is said to average about 10 feet in width.

The Silver Wing is the principal vein on the Silver Wing property and is considered to be the northeast extension of the Tom Moore vein. The mineralization is of a slightly different character than is usual throughout the area. There is appreciably more tetrahedrite and a much smaller amount of sphalerite, but the chalcopyrite and galena contents are about the same. It is reported that some of the ore mined from the Tom Moore vein during the early days carried as much as 70 ounces of silver per ton. It is reported that ore shipped from the Silver Wing contained 3 to 8 percent copper.

The country rock in the vicinity of the Silver Wing operation comprises principally rhyolite, whereas at the Great Eastern, which is considerably higher in altitude, it is andesite, both of which are of the Silverton volcanic series.

67/ Work cited in footnote 10.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Development and mining. - A considerable amount of work has been completed during the short span of operations by this organization. Surface work on the outcrop below the level of the upper tunnel exposed a deposit of sulfides of sufficient size and grade to warrant further exploration. The area is difficult of access because of the heavy talus, and it was decided to explore the zone from the lower tunnel. The ore does not extend to that depth, and a raise situated in a position to intersect the ore body near the center, as indicated by the outcrop, was started.

The raise of 3-compartment size was extended to a point about 140 feet before operations were suspended for the winter. It was reported that the last round entered minerals approaching ore in grade.

Snowslides, running earlier than usual, blocked roads and forced suspension of operations before it was possible to extend the raise far enough into the mineralized zone to permit appraisal.

At the Silver Wing, the vein has been explored by adits, and during early operations a crosscut was driven to cut the veins at considerable depth below the upper workings. It is reported that this tunnel is 1,000 feet in length and that it intersects the veins 300 to 1,000 feet below the upper workings. There is also reported to be some drifting along the vein from this level, but it is also reported that the minerals were not of sufficient grade to be classed as ore.

The Sioux City was rehabilitated during the 1947 season. Minerals of sufficient grade to be classed as ore were disclosed in the upper workings. A split check arrangement had been made for the extraction of ore, but work was started late in the season and, consequently, the production was limited.

Enough operating equipment was installed during the 1947 season so that operations can be resumed without delay as soon as access to the property is possible. A Diesel-powered, 310 cubic foot per minute-capacity, portable-type compressor should furnish enough compressed air for all work planned.

Mayday Mining Co.

The property of the Mayday Mining Co. is situated on the west side of Cement Creek about 3-1/2 miles north of Silverton, Colo. (fig. 2). It comprises 11 unpatented claims controlled by Ennis Cole and associates - A. G. Tilton, N. E. Pyeatt, and Adolph Binder. The claims were located during the early 1900's and have been variously owned since that time.

This group took over control of the property late in 1947 and had started rehabilitation. Their position near the county road, which traverses the valley of Cement Creek, is favorable and will probably permit year-round operation, should that be desirable.

It is reported that the mine was being operated by Drexler and Williams in 1929 and that they shipped 16 tons of lead-zinc-copper ore. The complete production records are not available, but workings accessible during the fall of 1947 did not indicate that the mine had made any appreciable production.

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Description of the deposit. - Several veins have been explored by the Mayday workings. Reports on file at the Bureau of Mines offices indicate that the Mayday vein strikes N. 37° W. and dips southwestward at about 71°. It also states that five samples taken in the Mayday stope averaged 7.9 percent lead, 9.5 percent zinc, 0.8 percent copper, 0.016 ounce gold, and 10.3 ounces silver per ton, and a width of 2.7 feet throughout a length of about 50 feet.

There are indications that some tonnage had been produced from other veins, but the pertinent information is not available.

Development and mining. - The portal of the Mayday tunnel, a crosscut adit, is a short distance, possibly 100 feet, above the county road and easily accessible from it by a private branch road. This tunnel, driven northwestward about 1,100 feet, is caved at about 800 feet from the portal. A north-south vein was intersected about 450 feet from the portal, and drifts were driven both north and south about 150 to 200 feet. Several other prospect drifts have been driven from the adit, and one to the south intersected the Mayday vein. The vein had been followed about 125 feet to the northwest, and the last 50 feet had been stoped to a height of about 25 feet. A raise driven from the northwest end of the drift extended 375 feet to the surface, according to the report.

The present operators had rehabilitated the Mayday tunnel to the caved portion, and the north drift on the vein intersected about 450 feet from the portal.

The installation of a 225 cubic foot per minute air compressor was in progress in this north drift during the early part of November 1947. The compressor was to be driven by an electric motor, and power was to be transmitted from the portal by a 3-conductor armored cable.

It was estimated that development to the north on the north-south vein would be started in about 2 weeks. It was also planned that ore to be obtained from the development and subsequent mining would be shipped by truck to the Shenandoah-Dives mill about 2 miles north of Silverton.

Philadelphia and Little Fanny

The claims known as the Philadelphia and Little Fanny are owned by Jack Gilaheany of Silverton, Colo., and are currently being operated by E. N. Helgerson on a leasing arrangement. Locally, the property is sometimes referred to as the Little Fanny mine, but others use the name Philadelphia. The Little Fanny claim adjoins the Philadelphia on the southeast, and Helgerson has located the Geddie claim adjoining the Little Fanny on the southeast. The three claims are on the extension of the Pride of the West vein and are situated high on the eastern slope of Cunningham Gulch (fig. 2).

It is reported by the operator that, during the early days of operation, ore taken from a surface cut about 150 feet in length and 20 feet in depth yielded 110,000 ounces of silver. The width of the vein or the number of tons of ore taken from the pocket are not known.

Generated on 2024-09-19 22:06 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Description of the deposit. - Since the vein at this location is the extension of the Pride of the West, similar conditions exist. It varies considerably in width along the strike, but throughout the mined areas it has been 3 to 7 feet wide.

In addition to the high-grade silver pocket previously mentioned, the mineral deposit is similar to that at the Pride of the West, consisting principally of quartz containing galena, sphalerite, some chalcopyrite, and variable amounts of pyrite. Helgerson reported that shipments made from the property in recent years contained $25 to $300 per ton silver. He further reported that samples from an ore shoot, which he has opened for a length of 40 feet, assayed from 26 to 500 ounces per ton in silver.

The altitude of over 12,000 feet at the mine is probably sufficient for the country rock, traversed by the vein, to be comprised of the Burns formations of the Silverton volcanic series.

Development and mining. - The property is difficult of access and is constantly subject to the menace of snowslides in winter, so that operations are generally confined to the period from June 15 to November 15, depending on prevailing weather.

The early work was done entirely by hand, but recent operators have installed a gasoline motor-driven compressor of about 200 cubic feet per minute capacity. They have compressed air-operated drills consisting of a drifter, stoper, and jackhammers, and the necessary air lines have been installed. Most of the 1947 season was consumed in rehabilitation and installation of equipment.

During the early operations, a stope about 180 feet in length was mined from the tunnel level to the surface. The present operators have extended the drift beyond the end of this stope. The vein was about 14 inches in width at the start of work, but opened to about 30 inches in the first round, and about 40 feet of drift has indicated that a width of 3 to 7 feet may be expected. Ore produced from this drift and stope preparations was shipped to treatment plants - two lots to the Shenandoah-Dives mill near Silverton and one, about 110 tons, to the American Zinc, Lead & Smelting Co. custom mill at Ouray. It was reported that the third shipment was sent to Ouray because of circuit changes and repairs in progress at the Shenandoah-Dives mill.

The present operators plan to start operations as early as possible in 1948, and after completion of 80 feet of raise and some stope preparation they expect to mine about 200 tons of ore monthly.

The ore is transported from the mine to the ore bin at the roadway by a gravity aerial tram, the difference in elevation being about 2,000 feet. The loaded bucket furnishes the power to draw the empty bucket back to the mine. Supplies are transported to the mine by this means.

Helgerson, the lessee, has worked alone a considerable portion of the time, although one man was employed during the latter part of the 1947 season. He plans to employ one miner during the 1948 season.

Generated on 2024-09-19 22:02 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The ore was transported from the ore bin at the roadside to the treatment plants by a Silverton trucking company. This company charged $1 per ton for transporting the ore to the Shenandoah-Dives mill near Silverton, and $5.50 per ton for transporting it to the American Zinc, Lead & Smelting Co. mill near Ouray. The schedule of payment for various metal contents by the treatment plants was not divulged, except the base rate, which was $4 per ton at the Shenandoah-Dives and $3.50 per ton at the Ouray plant.

Bandora (Esmeralda)

The Bandora mine, now operated as the Esmeralda lease, is on the south fork of Mineral Creek (fig. 2), about 6.3 miles from U. S. Highway 550, San Juan County, Colo. The property is owned by the John J. Sullivan Brokerage Co., Security Building, Denver, Colo., and is under a leasing agreement to N. C. Maxwell and associates. At present it is being operated on a split-check, sublease basis by T. E. Burgess, Ludwig Benigar, and John Mohney of Silverton.

The production records are not available, and the erratic operation over a considerable length of time suggests that were the records available they would probably be incomplete. The present operators have information in the form of reports, as well as from personal experience, which they made available.

Description of the deposit. - There are two eastward-trending, nearly parallel quartz veins exposed by the workings, and each has contributed to the production. Current operations are being carried out on the Bandora vein, which is north of the Little Todd. These veins are on the north side of the stream and are nearly parallel to the valley at that point. They intersect a light-colored quartzite, probably a stratum of the Dakota sandstone locally subjected to metamorphism.

The last shipment made before closing down during the fall of 1947 comprised 32 tons and was settled for by the Shenandoah-Dives Co. on the basis of 9.9 percent lead, 7.9 percent zinc, 1.25 percent copper, 13.7 ounces silver, and 0.12 ounce gold per ton.

The average of assays of samples from the Little Todd vein, taken by an engineer whose name was not obtained, indicated a content of 0.5 percent lead, 10.6 percent copper, 54 ounces silver, and 0.42 ounce gold per ton. The average length of the samples indicated the width of the vein to be 11 inches.

Development and mining. - Crosscut adits driven in a northerly direction at various elevations have afforded access to the veins. The present operations are being carried out on the 4th level, which is also accessible by a crosscut. It was reported that the workings on this level exceeded 1,200 feet in length.

The ore is extracted by the shrinkage-stoping method. It is necessary to hand-sort the larger pieces of quartzite from the ore, but to date the finer material has produced a net of $11.56 to $12 per ton after payment of royalties and trucking charges.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

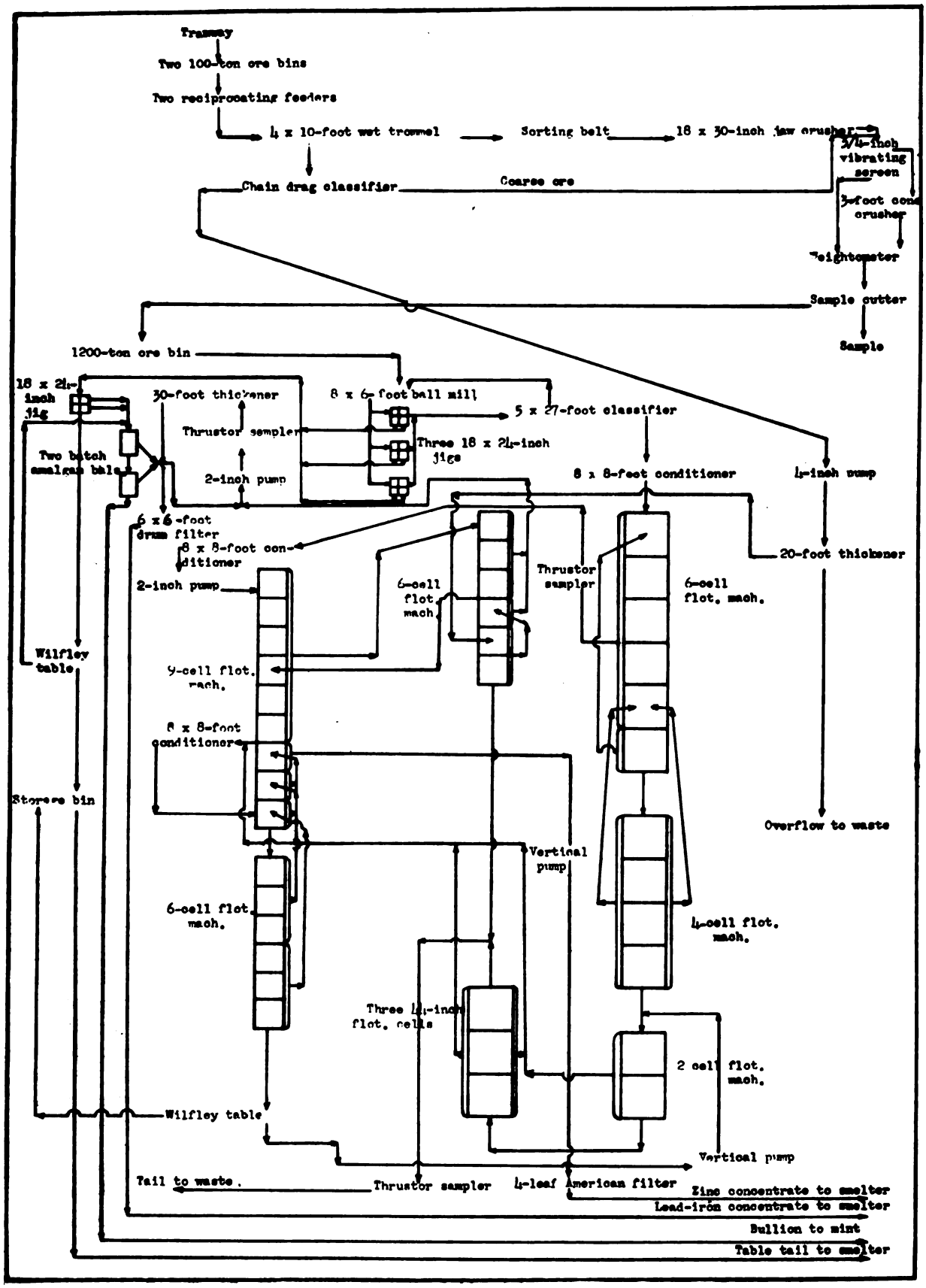

Figure 16. - Flow sheet of Telluride Mines, Inc., mill.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The lessees do not hire additional help. It is the duty of one of the members to maintain the compressor, a 215 cubic foot per minute-capacity, semiportable, gasoline-powered machine, in good operating condition. He also attends any other surface work that may be necessary.

MILLING OPERATIONS

Telluride Mines, Inc., Mill

The Telluride Mines, Inc., mill is at Pandora, Colo., 2 miles east of the Telluride post office. It is about 9,000 feet above sea level on a side-hill location favorable to the gravity flow of pulp. About half of its power requirement is furnished by the Western Colorado Power Co., and the remainder by the company's own hydroelectric plant. Water for the mill operation is taken from the power-plant tail sluice. The mill flow sheet features the use of jigs in the grinding circuit for the removal of coarse gold and heavy sulfide for treatment by barrel amalgamation. The washing plant removes oil-contaminated slimes and soluble salts.

A bulk flotation concentrate is made, which subsequently is selectively separated into galena-pyrite and sphalerite concentrates. The ball-mill feed belt is regulated by a feed control that uses the ball-mill noise level plus the classifier-rake load. The overflow density of the classifier pulp is regulated by an automatic density-control unit.

The ore is a complex sulfide, in which the precious metals are associated and intimately mixed with the sulfide minerals. No tellurides are reported. The gangue is siliceous.

Milling

The flow sheet of the Telluride Mines, Inc., mill is given in figure 16.

The mine run ore is crushed to minus 8 inches at the mine tramway terminal and is delivered to the two mill bins of 100-tons capacity each by the 3,500-foot aerial tramway. Each bin discharge is equipped with a reciprocating feed for moving the ore from the bin to a wet trommel screen. This screen furnishes a convenient method of washing the mud, oil, and other contaminating material from the ore, which, together with the minus 2-inch ore, is delivered to a chain drag classifier. The oversize from the trommel is discharged on a 36-inch belt, which transports the ore to an 18- by 30-inch jaw crusher. This belt is also used as a "picking belt," and the larger pieces of barren rock are discarded from the circuit at this point. The coarse ore from the classifier joins the crusher discharge, and the product is passed over a vibrator screen with 3/4-inch openings. The oversize is further crushed by a 3-foot short-head cone crusher, and is joined by the undersize from the screen. The product is passed over a weightmeter and the weight is recorded, after which the ore is sampled and delivered to the 1,200-ton fine-ore bin. The overflow from the chain drag classifier is pumped to a 20-foot Dorr thickener, and the overflow containing the oil accumulated from mining operations is allowed to flow to waste. The thickened pulp enters the circuit at the fifth cell of the 6-cell lead circuit.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The discharge from the fine-ore bin is moved to the ball-mill scoop feeder by a 24-inch conveyor belt. The amount of feed delivered to the 8- by 6-foot ball mill is controlled by a feed-control unit near the overflow end of the classifier. The ball-mill discharge is distributed to three 18- by 24-inch duplex jigs, and the tails flow into the 5- by 27-foot drag classifier, which delivers the sands to the ball-mill feed. The jig concentrate is cleaned in the fourth jig, and the concentrate of this jig is treated in two batch amalgamation barrels. The tails from the cleaner jig are tabled and the concentrates are added to the feed of the amalgamation barrels. The table tails are delivered to a storage bin, from which they are shipped to the smelter as desired. The amalgam from the barrels is retorted, and the bullion is sold directly to the mint. The reject from the amalgamation barrels joins the concentrate from the lead flotation circuit enroute to the 30-foot Dorr thickener.

The classifier overflows at 30 to 32 percent solids and is conditioned for 13 minutes in the 3- by 8-foot or No. 1 conditioner and becomes the bulk flotation-section feed at a pH of 8. The feed enters No. 1 cell and advances progressively through the six cells of the unit. The concentrate is sampled and flows to No. 2, or lead-circuit conditioner, and is prepared for the 6-cell bulk lead flotation section. The tails from the 6-cell bulk unit enter No. 1 cell of a 4-cell scavenger section. The concentrates from the section are returned to the fifth cell of the 6-cell unit. The tails from this section enter the first cell of a 2-cell flotation unit, the second scavenger unit. The concentrates from this unit enter No. 3 conditioner to be prepared for the zinc flotation section. The tails from this section enter the third scavenger flotation unit of three Fagergren-type cells. The concentrate from this unit joins the concentrate from the 2-cell unit and enters conditioner No. 3.

The pulp prepared in the second conditioner enters the lead flotation circuit at the first cell of a 9-cell unit. The unit, however, is closed between the sixth and seventh cells, and the tails leave the circuit there to enter No. 3 conditioner. The concentrate from the unit is cleaned in the first three cells of another 6-cell unit. The thickened pulp from the 20-foot Dorr thickener, the material washed from the ore during the trommel screening, enters the lead circuit at the fifth cell of this unit. The concentrates from the fifth and sixth cells are returned countercurrent to cell No. 4. The concentrate from the fourth cell joins with that from the first three cells and is thickened in the 30-foot Dorr thickener. The pulp from this thickener is filtered on a 6- by 6-foot Oliver drum filter, and the cake is delivered to box cars by conveyor. The tails from the lead cleaning unit pass to the No. 4 cell of the 9-cell unit.

The last three cells of the 9-cell unit are used in conjunction with a 6-cell flotation unit to form the zinc circuit. The pulp is prepared in conditioner No. 3, enters the circuit at No. 9 cell, and advances progressively through the seven cells. The concentrates from the ninth, first, second, and third cells are returned countercurrent to the eighth and seventh cells, which act as cleaner and recleaner, respectively, of the zinc concentrate. The concentrate from the seventh cell is pumped to a 4-leaf

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

American filter, and the cake is delivered to the zinc concentrate storage bin. The tails from the zinc flotation circuit are tabled on a Wilfley table, and the tails re-enter the circuit with the feed to the 2-cell scavenger unit of the bulk flotation section. The table concentrates join the table tails shipping product in the storage bin.

The reagents used at this mill, together with the amount and point of addition, are shown in the following table:

Name	Where added	Ore feed, pounds per ton
Am. Cy 404	Ball mill	0.1
Z-4	Conditioner No. 1	.032
Z-6	do.	.013
GNS No. 5	do.	.033
Alcohol (Penmasol)	do.	.005
GNS No. 5	Cell No. 3 of the 6-cell bulk unit	.010
Alcohol (Penmasol)	do.	.0015
Z-4	Cell No. 8 or the second cell of the 4-cell bulk unit	.03
Z-6	do.	.011
Alcohol	do.	.011
Cresylic acid	do.	.011
$CuSO_4$	Fag scavengers	.07
Z-8	do.	.025
Alcohol	do.	.005
$ZnSO_4$	Conditioner No. 2	.21 20% soln
404	do.	.007
Alcohol	do.	.004
Cresylic acid	do.	.004
Sodium sulfite	do.	.065 10% soln
NaCN	Cell No. 1 of the lead circuit	.01
Alcohol	Cell No. 1 of the cleaning section	.001
Z-4	Slime circuit	.09 per ton slime
Z-6	do.	.03 per ton slime
GNS No. 5	do.	.25 per ton slime
Aerofloat 25	do.	.013 per ton slime
Lime	Conditioner No. 3	.9 best feeder
Copper sulfate	do.	.07 set at 45° F.
NaOH	do.	.23
NH_4OH	do.	.13
Z-4	do.	.004
Z-8	do.	.002
Sodium aerofloat	do.	.01

Generated on 2024-09-19 22:04 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Typical analyses of various mill products and ratios of concentration are given in the following table:

Product	Oz./ton		Percent		
	Gold	Silver	Lead	Zinc	Copper
Heads	0.17	1.5	1.0	1.0	0.05
Lead concentrate	1.30	12.0	15.0	3.5	.5
Zinc concentrate	.25	8.0	2.0	52.0	.5
Table concentrate ...	2.20	8.0	6.0		.15
Mill tailings	.012	.3	0.03		-

	Ratio of concentration
Lead concentrate	14 to 1
Zinc concentrate	130 to 1
Table concentrate	70 to 1
Calculated over-all recovery, percent	88.7

Idarado Mining Co. Mill

The mill is at the portal of Treasury tunnel, 12 miles south of Ouray, Colo., on Highway 550. The elevation is 10,625 feet above sea level. Ores are produced from the company's operations on the Black Bear vein, a compound vein that has been formed from several overlapping stages of mineralization. The ores consist of complex sulfides of copper, lead, and zinc in a quartz gangue. The chief ore minerals are galena, sphalerite, tetrahedrite, freibergite, bornite, and chalcopyrite. The galena is argentiferous. Much of the sphalerite contains little or no iron. Gold is associated with the sulfides and is also found in the quartz gangue.

During the early operations of the Black Bear mine in Ingram Basin, the ore was delivered by aerial tramway to treatment plants in the vicinity of Telluride. Metallurgical tests conducted on ore encountered in the Treasury tunnel were favorable, and a 250-ton mill was constructed near the portal of the tunnel and placed in operation during 1945. The mill served as a pilot plant and permitted treatment of ore produced by development. The plant was operated during 1947 and 1948, approximately as installed, although plans for expansion have been prepared and some construction has been started. The plans include the underground installation of the primary crushing, which will be placed in operation about May 1, 1949. It is expected that 3 or 4 months will be required before the changes necessitated by this installation will be operating efficiently.

Milling

A considerable portion of the information on milling was abstracted from a report by F. W. McQuisten, Jr.,68/ metallurgical engineer for Newmont Mining Co.

68/ McQuisten, F. W., Jr., Milling Practice at Idarado Mining Co.: A.I.M.E. Mining Technology, May 1948, 6 pp.

Generated on 2024-09-19 22:07 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

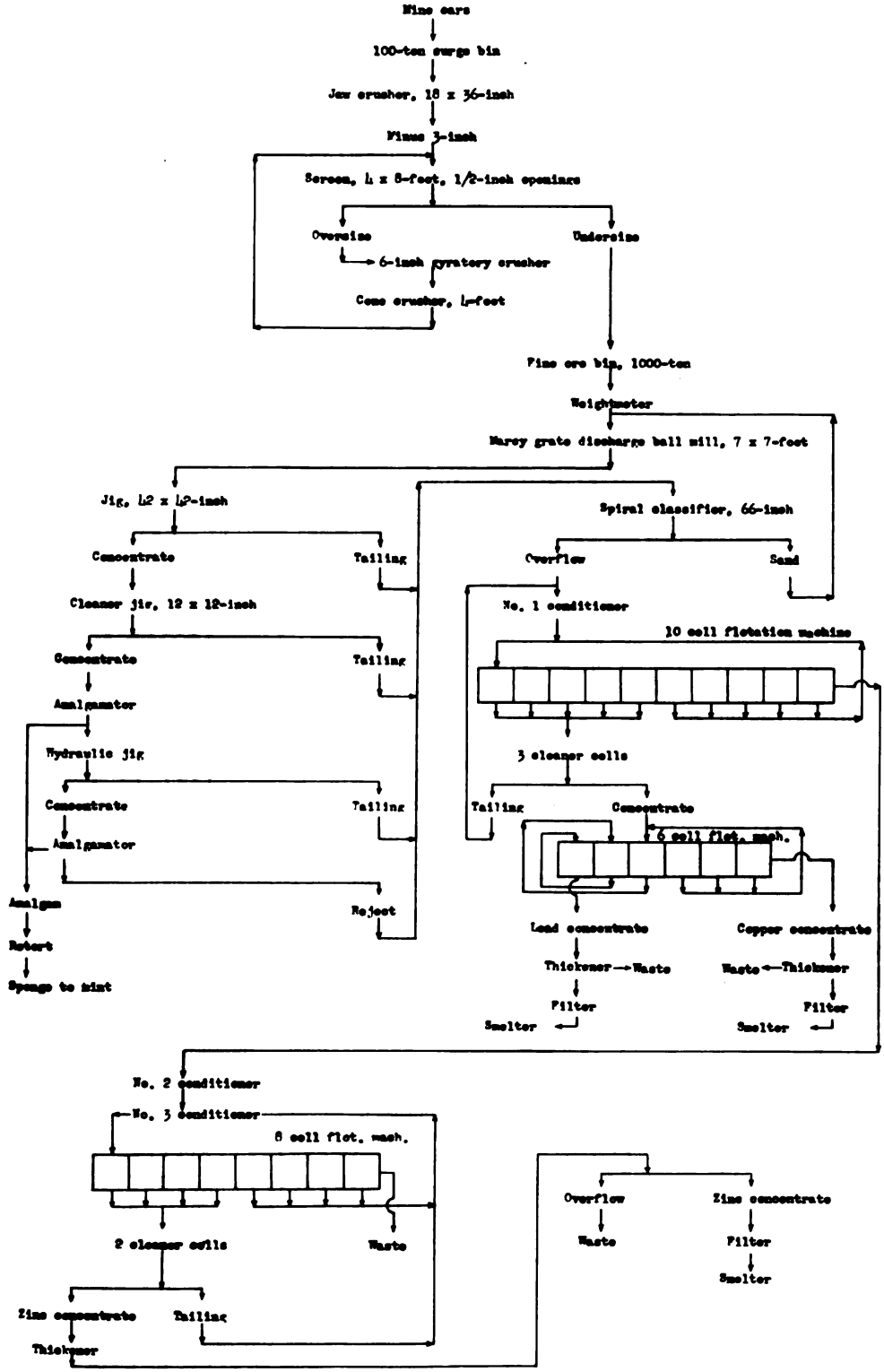

Figure 17. - Flow sheet of the Idarado mill.

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The flow sheet of the Idarado mill is shown in figure 17.

As now in use (1948), the surface crushing unit consists of an 18- by 36-inch jaw crusher discharging minus 3-inch material, which passes over a 4- by 8-foot screen with 1/2-inch openings. The undersize goes direct to the fine-ore bin. The oversize passes to a 6-inch gyratory crusher, followed by a 4-foot cone crusher in closed circuit with the 4- by 8-foot screen. The crushed ore stored in the 1,000-ton fine-ore bin is delivered to a 7- by 7-foot Marcy-type grate-discharge ball mill by a belt conveyor that passes over a Merrick weightmeter.

The reagents used, together with the amount and place of addition, are as follows:

Reagent	Pounds per ton of mill feed	Place of reagent addition
A. C. No. 404	0.05	Ball mill
Zinc sulfate	1.50	Do.
Sodium cyanide	.10	Do.
Lime	2.00	Do.
Amyl xanthate	.025	Classifier pool
Do.	.025	Staged to copper-lead flotation
Zinc sulfate	.20	Copper-lead cleaners
Sodium Sulfite	.20	Do.
Sodium cyanide	.30	Copper-lead separation
Sodium sulfite	.15	Do.
Copper Sulfate	1.00	First zinc conditioner
Z8 potassium butyl xanthate	.15	Second zinc conditioner
Lime	3.00	First zinc conditioner
DuPont B23	.20	Frother where required

A typical mill head contains 1.40 percent lead, 2.70 percent zinc, 0.70 percent copper, 0.07 ounce gold, and 2.70 ounces silver per ton. The following table gives the distribution of recovered metals in various products over a 1-month period.

	Percent distribution				
	Gold	Silver	Copper	Lead	Zinc
Flotation feed	100.00	100.00	100.00	100.00	100.00
Copper concentrates	76.39	30.61	87.45	5.35	3.32
Lead concentrates	5.66	59.27	3.36	91.46	1.53
Zinc concentrates	4.90	4.68	5.73	1.79	88.14
Tailings	13.05	5.44	3.46	1.40	7.01

The practice of recovering free gold in jigs, common in the San Juan region, is employed at the Idarado mill. The ball-mill discharge flows to a 42- by 42-inch jig, the concentrate passing through a 12- by 12-inch cleaner jig. From the cleaner jig the concentrate enters a Titan amalgamator. The reject from the amalgamator is treated again by jigging, the concentrate

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

from this operation passing through a batch amalgamator. The tailing from the jig and amalgamator circuit is sent to a 66-inch classifier, whereas the amalgam obtained from the two amalgamators is retorted. The bullion is shipped to the Denver mint. Approximately 35 percent of the gold in the ore is recovered in this circuit.

The classifier overflow is maintained at 30 percent solids and is conditioned 10 minutes before it enters the copper-lead flotation circuit at the first cell of a 10-cell bank of flotation machines. According to McQuisten,69/ "The scavenger concentrates from the last five cells are returned to the head of the circuit." Rougher concentrates from the first five cells are cleaned and recleaned in single machines, the tails from these machines being pumped back to the No. 1 (copper-lead circuit) conditioner. The copper-lead concentrate is fed to the third cell of a bank of six No. 18 special cleaner cells. "A dilution of 9 to 1 is maintained in the circuit." The froth from the third cell is fed countercurrently to cell 2, and the froth from cell 2 is fed countercurrently to cell 1, these two cells acting as cleaner and recleaner, respectively, of the lead concentrate, which is thickened and filtered and delivered to the lead-concentrate-shipping bin. The froth from cells 4, 5, and 6 re-enters the circuit at 3 cell, and the tailing from these cells becomes the copper concentrate that is thickened, filtered, and delivered to the copper-concentrate bin. It has proved economical to maintain the lead content of the copper concentrate as low as possible because of the more favorable smelter payment for copper in the lead concentrate over lead in the copper concentrate.

The tailing from the copper-lead bulk flotation circuit is conditioned in two stages in the No. 2 and No. 3 conditioners for 10-minute periods, then becoming the zinc flotation feed at a density of 25 percent solids. The zinc flotation unit consists of 8 cells, and the froth flow is similar to that in the copper-lead separation circuit. The feed enters the circuit at cell 1, the froth from the first four cells passing to a unit cleaner cell and a recleaner cell. The froth from the scavenger cells, 5 to 8, re-enters the circuit in the No. 3 conditioner with the tail from the two cleaner cells. The concentrate from cells 1 to 4 is thickened, filtered, and delivered to the zinc concentrate shipping bin. The tail from the zinc circuit is sent to waste at 22 percent solids, together with the overflow from the zinc concentrate thickener.

King Lease Mill

The King Lease mill is a remodeled section of the old Camp Bird gravity-stamp-amalgamation mill and makes use of about one-fifth of the floor space under cover in that previous operation. The mill, which has a nominal capacity of 140 tons per 24 hours, is situated at the mine portal about 6 miles southwest of Ouray at an elevation of 9,790 feet. Amalgamation plates are used for the recovery of gold, and the plant is being arranged to selectively float the amalgamation tails for the production of a lead and zinc concentrate. A bulk flotation concentrate of these sulfides is being shipped at this time (December 1947). The connected power load is 200 horsepower

69/ Work cited in footnote 68.

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

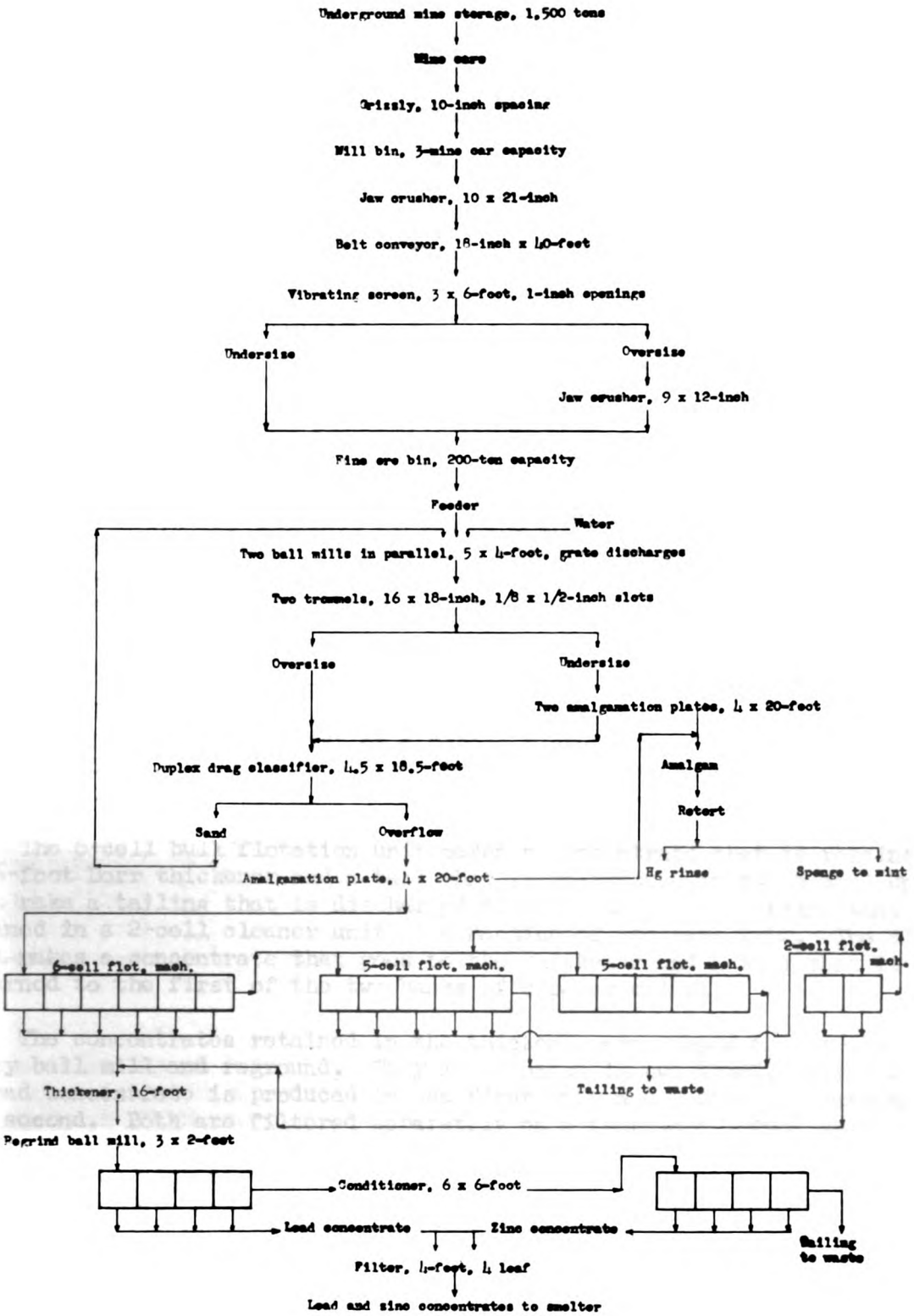

Figure 18. - Flow sheet of the King Lease mill, Camp Bird mine.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The ore is a complex sulfide containing galena, sphalerite, and pyrite with associated silver and free gold. The gangue minerals besides pyrite are quartz, calcite, and andesite breccia of the country rock. The mining operation provides a 1,500-ton retention storage underground, which is sufficient for 10 days or more of mill operation. Ore is delivered by mine cars direct to the mill.

Milling

The flow sheet of the mill arranged for selective flotation is shown in figure 18.

The crushing unit consists of a primary 10- by 10-foot Telsmith jaw crusher and a 9- by 12-inch secondary jaw crusher. The primary crusher discharges to 3- by 6-foot vibrating screen, from which the oversize goes to the secondary crusher. The discharge from the secondary crusher and from the screen is conveyed to a 200-ton capacity fine-ore bin. The ore from the bin, controlled by feeders, is charged to two 5- by 4-foot grate-discharge ball mills in parallel, equipped with 16- by 18-inch trunnion trommels with 1/8- by 1/2-inch slots. The undersize passes over amalgamation plates; thence, with the oversize, advances to a 4.5- by 18.5-foot duplex drag classifier. The classifier sands return to the grinding circuit, and the overflow passes over amalgamation plates to the flotation unit.

Three 4- by 20-foot amalgamation plates are arranged in series for the fine-ore flow. The plates are cleaned periodically, and the amalgamation tails are pumped to the first of a 6-cell flotation unit. The amalgam is retorted, sponge gold is shipped to the Mint, and mercury is returned to the plates.

The 6-cell bulk flotation unit makes a concentrate that is retained in a 16-foot Dorr thickener and a tail that is re-treated in two 5-cell units that make a tailing that is discharged to waste and a concentrate that is cleaned in a 2-cell cleaner unit of a machine of the same type. The cleaner cell makes a concentrate that goes to the thickener and a tail that is returned to the first of the two banks of cleaner cells.

The concentrates retained in the thickener are pumped to a 3- by 2-foot Marcy ball mill and reground. They are floated in two 4-cell units, where a lead concentrate is produced in the first unit and a zinc concentrate in the second. Both are filtered separately on a four-leaf 4-foot American filter. A 6- by 6-foot conditioner between the two units prepares the lead tails for the zinc circuit, and tails of the zinc circuit go to waste.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The following table gives some data on reagents and the mill circuit.

Where added	Reagent	Pounds per ton	How added
Ball mill	Sodium sulfite ..	3.7	20 percent solution
	Sodium cyanide ..	0.54	10 percent solution
	No. 404	.30	5 percent solution
	Zinc sulfate	3.7	20 percent solution
Conditioner	Copper sulfate ..	1.37	saturated at 68°.
	Sodium aerofloat.	.20	5 percent solution
Dia. pump	Soda ash	4.00	
	Metso	1.00	As 4-1 mix
Zinc circuit	Lime	4.00	Solid
	Pine oil	12 drops per min.	Visual need
Pump at head of ..	Z-6	.76	
lead circuit	Pine oil (GNS 5).	.149	

Ball-mill data:

Density of discharge 62 percent solids plus 200 mesh 13 percent

pH of mill water from mine 7.8
pH of ball mill discharge 9.0
pH of zinc head 10.0
pH of zinc tails 11.0

Classifier overflow, 37 percent solids

The following table gives the typical grade of various mill products.

	Oz./ton		Percent				
	Gold	Silver	Lead	Zinc	Copper	Iron	Insol.
Mill feed	0.10	4.2	2.06	2.12	0.38	17.28	-
Bulk flotation concentrate	.86	32.0	12.3	17.6	3.72	18.8	14.0
Lead concentrate ...	1.12	54.6	21.4	7.2	5.98	23.1	7.4
Zinc concentrate ...	.31	13.1	4.4	50.1	1.77	5.3	4.4
Mill tailings	.012	0.46	0.15	0.13	.03	-	-

American No. 1 Custom Mill

The American No. 1 custom mill is owned and operated by the American Zinc, Lead & Smelting Co. In addition to the information obtained from the operators, some information was obtained from a report by D. C. McLean, Hildreth Frost, Jr., and M. L. Kay.70/

The mill situated at Ouray, Colo., was purchased during 1946, and the company has spent considerable time and effort on remodeling during 1947 and the early part of 1948. The plant will have a daily capacity of 350 tons when remodeling and installation of equipment now at hand are completed.

70/ McLean, D. C., Frost, Jr., Hildreth, and Kay, M. L., Custom Milling American Lead & Smelting Co., Ouray, Colo.: Deco Trefoil, Denver Equipment Co., November and December 1948.

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

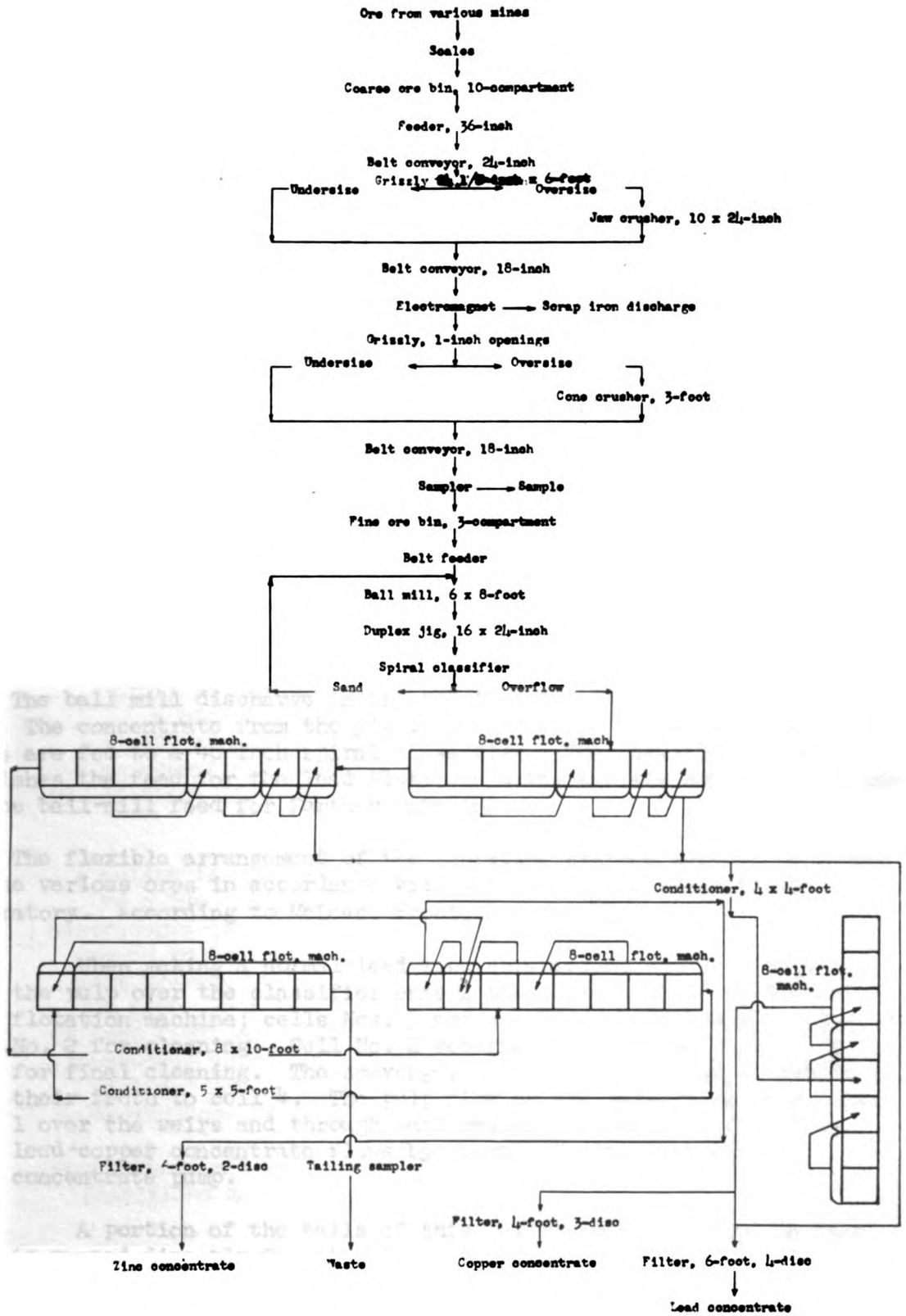

Figure 19. - Flow sheet, American No. 1 mill.

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The plans contemplate treatment of custom ore from the various mines in the district which are not equipped with milling facilities. Laboratory and testing units are being prepared for the study of ores from mines that deliver custom ores.

Milling

The flow sheet of the mill is shown in figure 19.

The coarse-ore bin is designed for the reception of custom ore as well as that produced from the company-operated properties. It has 10 compartments that permit truck deliveries from various properties simultaneously. A truck-size scale has been installed, so that the weights of deliveries can be made easily. The arrangement facilitates segregation of ore from various sources. These bins discharge onto a 24-inch conveyor belt, which delivers the ore to a 24-1/2-inch by 6-foot grizzly. The oversize, plus 2-inch material, passes through a 10- by 24-inch jaw crusher and joins the undersize of an 18-inch conveyor belt, which delivers the product to a 3-foot cone crusher. This crusher discharges minus 1/2-inch material to a second 18-inch conveyor belt, the discharge end of which is equipped with a bucket sampler that cuts 2-1/2 percent of the feed for a sample. This sample is cut again to the desired final amount, and the reject rejoins the feed to the selected storage bin. The storage bins discharge to another feed belt, which delivers the ore to a 6- by 8-foot overflow ball mill.

The ball mill discharge is treated in a 16- by 24-inch duplex mineral jig. The concentrate from the jig is delivered to the storage bin, and the tails are fed to a 40-inch spiral classifier. The classifier overflow furnishes the feed for the lead flotation unit, and the sands are returned to the ball-mill feed for further grinding.

The flexible arrangement of the flotation section permits treatment of the various ores in accordance with information obtained by the laboratory. According to McLean, Frost, and Kay:71/

> When making a normal lead-zinc separation, the main flow of the pulp over the classifier enters the third cell of an 8-cell flotation machine; cells Nos. 3 and 4 return their froth to cell No. 2 for cleaning. Cell No. 2 returns its froth to cell No. 1 for final cleaning. The scavenger cells (5, 6, 7, and 8) return their froth to cell 4. The pulp flow of the machine is from cell 1 over the weirs and through sand reliefs to cell 8. The final lead-copper concentrate flows by gravity to the lead-copper concentrate pump.
>
> A portion of the tails of this lead-copper flotation machine is pumped directly from the lower tailing zone of cell 8 onto a pilot table. This table allows the operator to see even the slightest amount of lead (in most ores) in the lead circuit

71/ Work cited in footnote 70.

Generated on 2024-09-19 21:59 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

tails. It also gives him a visual idea of the amount of zinc and iron in the ore and what to expect in the zinc circuit.

The tailings from the first flotation bank flow by gravity into cell No. 1 of a second 8-cell flotation machine wherein the froth and pulp flows are the same as described above. This bank ordinarily functions as a lead scavenger unit, the concentrate from which is pumped to cell 4 in the first bank. Under unusual conditions, this bank can be used for making either a lead-zinc middling or a zinc concentrate.

The tailings from the lead scavenger bank flow into a large surge box and then by gravity into the standpipe of an 8- by 10-foot conditioner for reactivation of the zinc. Copper sulfate is added at the surge box and lime into the top of the conditioner.

The discharge from the zinc conditioner enters the first zinc circuit bank at the rear of the third cell. The pulp and froth flows in this bank are the same as those previously described. A second pilot table is provided for visual control of this zinc circuit.

The tailings from the first zinc machine flow by gravity to a pump which lifts the pulp into a 5- by 5-foot conditioner. From the conditioner, the pulp flows into cell No. 1 of a fourth 8-cell flotation machine. In this machine the froth from cells Nos. 2, 3, 4, 5, 6, 7, and 8 discharge into a common launder which returns the froth to cell No. 1. The concentrate from cell No. 1, when the bank is functioning as a zinc scavenger, is pumped to the first cleaner cell (cell No. 2) of the first zinc machine.

For ores containing sufficient copper to warrant making a lead-copper separation, an 8-cell flotation machine and a 4- by 4-foot conditioner are provided. The lead-copper concentrate can be pumped into the conditioner where either lead or copper depressants can be added. The pulp then flows by gravity into cell 5. Cells 5 and 6 return their froth to cell 4. Cell 4 returns its froth to cell 3. Cell 3 overflows the final lead or copper concentrate (depending upon the mineral being depressed). The froth from cells 7 and 8 returns to cell 6. The tailings from cell 8 constitute the final lead (or copper) concentrate.

The first two cells are not used as part of the lead-copper separation circuit, but are designed to function as additional lead-copper concentrate cleaners if needed.

Laboratory tests indicate the reagents to be used for the ores from various customers; consequently, various combinations are in use, and about the only constituent that remains constant is the feed water, which has a pH of 7.8.

Generated on 2024-09-19 21:57 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

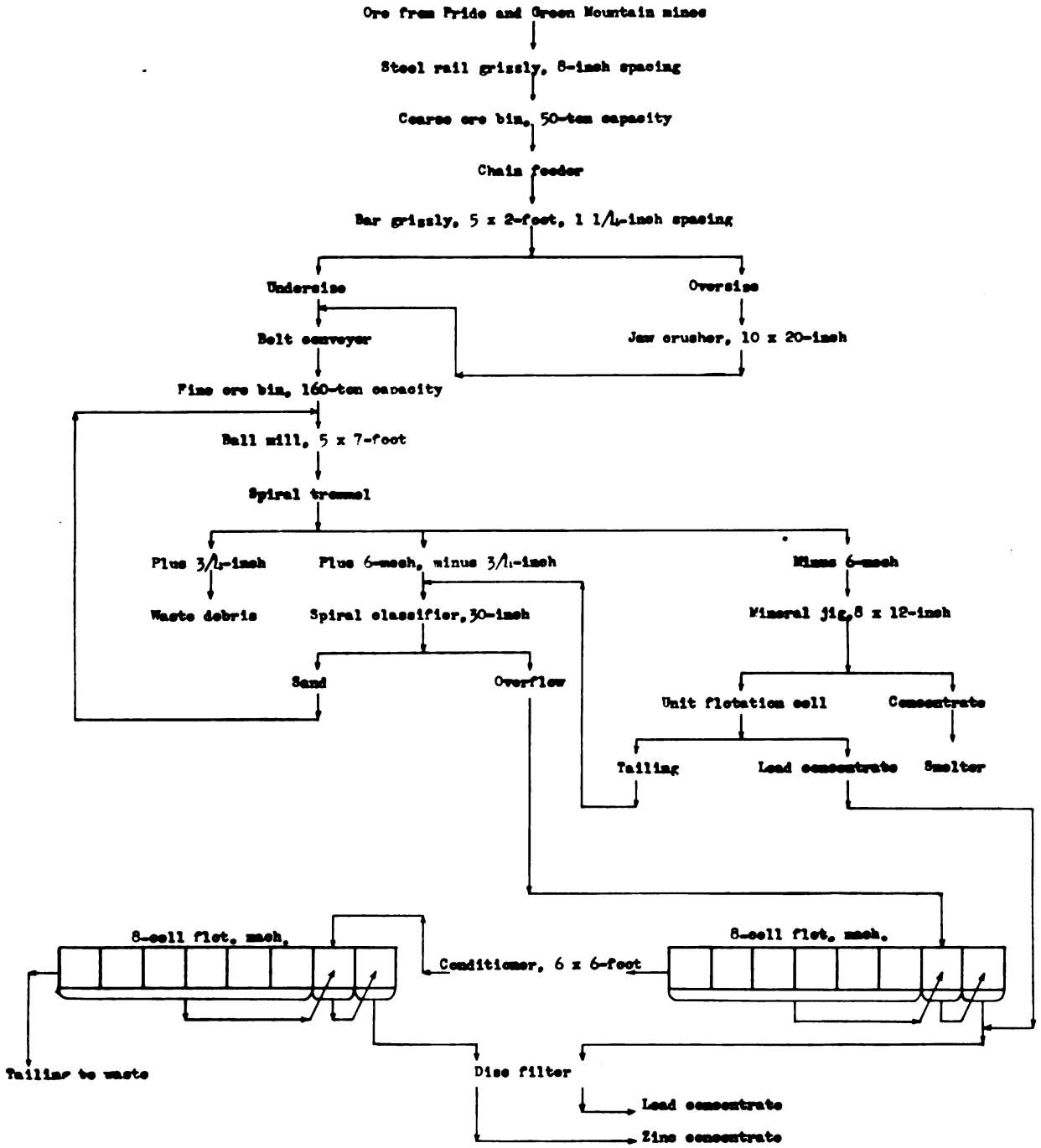

Figure 20. - Flow sheet, Pride of the West mill.

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

An example of the reagents and the place of introduction is shown in the following table. No reagents are added to the ball mill feed.

Classifier overflow:

Amyl Alk 124	10 to 15 drops per minute
B-23, B-24 Dupont	As needed

Lead circuit:

Sodium sulfite	0.5 lb. per ton (5 percent solution)
Zn sulfate	1.0 lb. per ton (10 percent solution)
NaCN	.05 lb. per ton (10 percent solution)
Z-4 and 404	.05 lb. per ton (mixture 50 percent)
Metso	.3 lb. per ton

Lead cells:

Zinc sulfate	0.1 lb. per ton
Sodium sulfite	.1 lb. per ton
NaCN	.03 lb. per ton

Zinc circuit:

Conditioner:	
Copper sulfate	1 lb. per ton (sat. at 40° solution)
Lime	To a pH of 10-11 in tails
Z-5	0.05 lb. per ton
First cell:	
Frother	As needed
Scavenger cells:	
Copper sulfate and lime.	As needed

Pride of the West Mill

The Pride of the West mill is at Howardsville on State Highway 110, about 5 miles northeast of Silverton, Colo., at an altitude of 9,000 feet. Two mines, the Pride and the Green Mountain properties of the company, supply the ore for the mill. These mines are about 2 miles up Cunningham Gulch at an altitude of 10,000 feet.

The mill was constructed in the summer of 1940 and has operated continuously to January 1, 1948. It was originally designed to treat 50 tons per day but was enlarged during the war to handle 110 tons.

The mill flow sheet (fig. 20) is featured by the introduction following the ball mill of a jig and a unit flotation cell to remove the coarsely liberated sulfide particles.

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The ore minerals are galena, sphalerite, tetrahedrite, chalcopyrite, and some native gold and silver. The pyrite appears to carry but little of the precious metals that are associated with and included in the lead and zinc sulfides. Most of the silver occurs in the tetrahedrite. Quartz is the chief gangue mineral, but there are smaller amounts of calcite and andesite country rock. The copper content of the ore has increased slightly with depth, especially in the Green Mountain workings.

Milling

Mine-run ores from the two company-operated mines in Cunningham Gulch are delivered to the mill by trucks owned by a Silverton trucking contractor. The loaded trucks are dumped on an 8-inch grizzly constructed of steel railroad rails, and the oversize is hand-broken to pass through the grizzly. The coarse ore is drawn from the bin over a 5-by 2-foot grizzly with bars spaced at 1-1/4 inches. The undersize from the grizzly falls onto a conveyor belt, which delivers it to the 160-ton fine-ore storage bin within the mill building. The oversize from the grizzly is crushed by a 10- by 20-inch jaw crusher and joins the grizzly undersize on the conveyor for delivery to the fine-ore bin.

The fine ore is delivered to a ball mill by a conveyor belt, which draws from the center of the bin. As originally installed, the ball mill was 5 by 5 feet, but a 2-foot section was welded to it, making it 5 by 7 feet. The ball mill discharges through a 6-mesh spiral screen; the oversize enters the 30-inch Akins classifier and is returned to the ball mill for further grinding. The undersize of minus 6-mesh material is treated in a mineral jig, which produces a concentrate that is drained and shipped to the smelter. The tails from the jig are passed through a unit flotation cell, which produces a concentrate that is pumped to the lead filter with the concentrate from the lead circuit, and the cake is delivered to the shipping bin. The tails from the unit cell are returned to the classifier with the plus 6-mesh ball-mill discharge. The classifier sands discharge at 70 percent solids; lead flotation reagents are added, and they are returned to the ball mill. A water spray is maintained on the classifier screen to bring the pulp to the desired density for the flotation section.

The classifier overflow enters the second cell of an 8-cell bank, which comprises the lead flotation circuit. The concentrate from this cell is cleaned in the first cell, the tails passing on through the circuit with those from No. 2 cell to the zinc circuit conditioner. The cleaned lead concentrate from the first cell is filtered, and the cake is delivered to the shipping bins. The froth from the last six cells is returned to the circuit at the second cell with the classifier overflow.

The lead circuit tails are conditioned with reagents for 40 minutes in a 6- by 6-foot conditioner. The conditioned pulp enters the zinc circuit at the second cell, and the flow is similar to that used in the lead circuit. The tails from this circuit are sent to waste storage for settling. The concentrates from the zinc circuit are filtered, and the cake is delivered to the shipping bins.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The ore does not contain enough copper to warrant installation of equipment for producing copper concentrate.

The following table shows reagents and amounts used and the point in the circuit at which they are added.

Reagents	Pounds per ton	How fed	Where fed
Soda ash	1.0	Dry	Ball mill
Zinc sulfate	1.0	25-percent solution	Do.
NaCN	.25	10-percent solution	Do.
Yarmor F	.05	As received	Do.
Z-3	.13	5-percent solution	Do.
Z-3	.09	5-percent solution	Classifier overflow
Sharples Alc No. 124	.05	Undiluted	Do.
Copper sulfate	.65	Saturated	Zinc conditioner
Lime	2.0	Dry	Do.
Z-3	.14	5-percent solution	Do.
Z-3	.09	5-percent solution	No. 5 zinc cell
Yarmor F	.10	As received	Do.
Cresylic acid			Zinc conditioner

Note: Ball-mill reagents fed with sand return from classifier.

The analyses of typical mill products are shown in the following table:

Product	Concentration ratio	Gold	Silver	Lead	Zinc	Copper	Iron	Insol.
Head	-	0.08	4.1	4.75	1.90	0.14	-	-
Jig concentrate	18 to 1	2.51	40.9	66.1	1.20	1.32	-	-
Unit cell concentrate	4 tons per day	.10	15.0	69.5	2.50	-	7.8	6.3
Lead concentrate	16.5 to 1	.81	50.7	58.2	5.10	2.66	-	-
Zinc concentrate	76 to 1	.225	23.2	4.5	46.5	1.24	-	-
Tailings	-	.008	0.7	0.30	0.35	.03	-	-

Highland Mary Mill

The Highland Mary mill is in Cunningham Gulch, 1,200 feet from the mine and 650 feet lower in elevation. The mill handles 100 tons of ore per day and makes a bulk flotation concentrate and a jig concentrate. Power is purchased from the Western Colorado Power Co. during the low-water season, but when water is plentiful the company's own water wheel develops enough power to operate the plant. The present company has operated this old-time property since 1940, and the ore, which 30 to 35 years ago assayed more than 100 ounces of silver and three-quarters of an ounce of gold, during 1947 contained 1.32 percent lead, 0.16 percent copper, 0.10 ounce gold, and

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

4.81 ounces silver per ton. The ore minerals are galena, chalcopyrite, tetrahedrite, tennantite, sphalerite, gold, and silver. The precious metals are usually associated with the gray copper minerals but also with the galena.

Milling

The ore is crushed at the mine to minus 1-inch in a 9- by 16-inch jaw crusher and delivered to the mill by a 1,200-foot aerial tram. The fine-ore storage bin has a capacity of 250 tons and discharges to an 18-inch conveyor belt, which delivers the feed to the 6- by 4-1/2 foot Marcy-grate ball mill. The ball-mill discharge is classified by a 48-inch Akins classifier; the overflow becomes the flotation feed. An 8- by 12-inch duplex mineral jig is installed in the ball mill-classifier circuit, taking the discharge from the ball mill, the jig tailing passing to the classifier. The concentrates are drained and sacked for shipment. The company's records indicate that 20 to 40 percent of the gold in the ore is recovered by the jig.

The classifier discharge is composed of about 5 percent plus 65-mesh and 60 percent minus 200-mesh material. The feed enters the bulk flotation circuit, which is composed of eight cells. The tails are tabled for visual assay and are sent to waste storage. The concentrates produced by this circuit are dewatered by a 4-foot, 2-disk filter and are delivered to the storage bin.

The flotation reagents Am Cy No. 404 and Z-6 are added to the circuit with the ball mill feed, and Z-6 and Yarmour F are added at the flotation cells.

Analyses of typical mill products are as follows:

	Oz./ton		Percent		
	Gold	Silver	Lead	Zinc	Copper
Jig concentrate	33.85	111.8	59.8	0.50	0.15
Bulk flotation concentrate	1.92	91.7	32.2	1.10	2.50
Tailings	.01	.50	.15	.11	.03

Note: Recoveries for 1947 were 90.3 percent gold, 87.1 percent silver, 89.1 percent lead, and 75.8 percent copper.

The plant is very well-arranged and is maintained in excellent operating condition.

Lead Carbonate Mill

The Lead Carbonate is a 50-ton mill built in the summer of 1947 and situated at the old mining camp of Gladstone, San Juan County, Colo. It is on a side-hill location but is free from the danger of snowslides, has abundance of mill water, and adequate room for tailing disposal.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

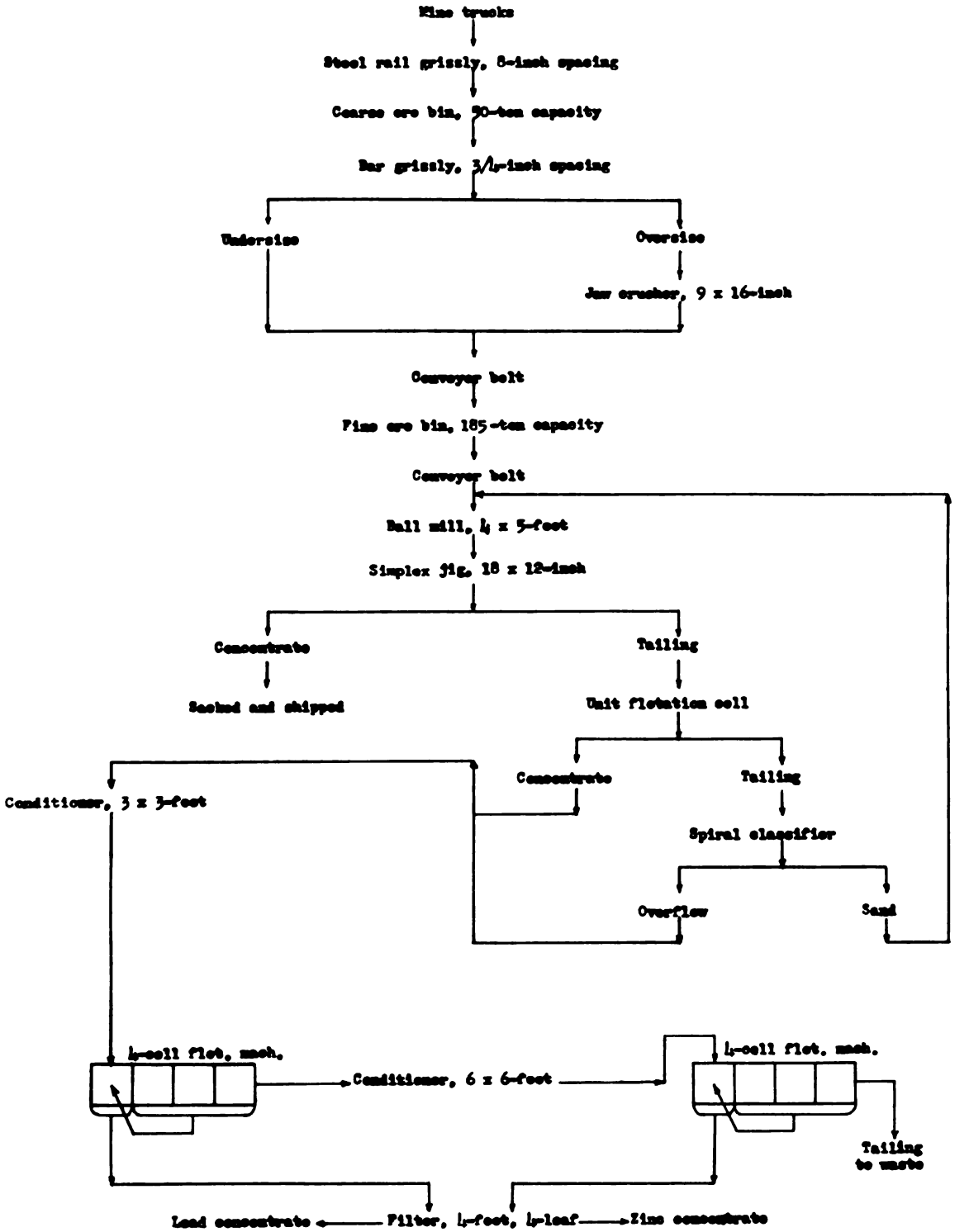

Figure 21. - Flow sheet of the Lead Carbonate mill.

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The ore is obtained from the Lead Carbonate mine 1-1/2 miles east of Gladstone at an elevation of 11,600 feet. Native gold and silver are associated with the complex base-metal sulfides. The gangue is siliceous, and relatively large amounts of rhodonite are found in places.

Milling

The flow sheet of the Lead Carbonate mill is shown in figure 21.

The mine-run ore is delivered to the mill by trucks owned by a Silverton trucking company and operated on a contract basis. The ore is dumped on a grizzly constructed of railroad rails spaced 8 inches apart, and the oversize is hand-broken into the bin below. As the ore is drawn from the bin, it passes over a bar grizzly with bars spaced 3/4 inch apart. The undersize falls onto a conveyor belt that passes beneath the discharge of the 9- by 18-inch Telsmith jaw crusher and delivers undersize and discharge from the crusher to a 185-ton capacity fine-ore bin. A conveyor belt driven by a variable-speed motor delivers the ore to the 4- by 5-foot ball mill for fine grinding. The ball-mill discharge is treated in an 18- by 12-inch simplex jig; the concentrates are drained and sacked for shipment to the smelter. The jig tails are fed to a unit flotation cell, which produces a concentrate that is pumped to the conditioner for the lead circuit. The tails from the unit cell flow into the 30-inch Akins classifier, which delivers the sands to the ball mill for further grinding. The classifier overflow joins the concentrate from the unit cell at the 3-foot lead circuit conditioner.

The conditioned pulp enters the lead circuit at the first of four cells that comprise the circuit. The concentrate from the first cell is pumped to the filter, and the froth from the last three cells enters the circuit with the feed at the first cell. The tails from this circuit are pumped to the zinc section 6- by 6-foot conditioner and are fed to the zinc flotation cells. The feed enters the circuit at the first of four cells comprising the bank, and the flow is similar to that of the lead circuit. The concentrates are filtered and the cake is delivered to the shipping bin, and the tails are settled at the settling pond adjacent to the mill. No copper concentrate is made at this plant, as the copper content of the ore does not warrant it.

The jig concentrate contains the greater portion of the "free" gold, and is probably the more important part of the concentrates that are produced.

The reagents added to the circuit at the ball mill are as follows:

	Lb. per ton
Thiocarbonolid	0.4
Zinc sulfate	.5
Sodium cyanide	.4
Z-3	.05-0.15
Yarmour F	.1

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The following reagents are added in the lead circuit conditioner:

	Lb. per ton
Lime	0.6
Z-3	.08
Yarmour F	.11

The reagents added at the zinc circuit conditioner are:

Copper sulfate... 1.5 lb. per ton and lime 2 lb. per ton
Sodium aerofloat. .1 lb. per ton

Analyses of typical mill products are shown in the following table:

	Oz./ton		Percent				
	Gold	Silver	Lead	Zinc	Copper	Iron	Insol.
Mill head	0.79	9.70	6.05	5.90	1.03	-	-
Jig concentrate	10.0-140.0	75.0	79.2	-	-	5.8	1.2
Lead concentrate	1.35	54.6	55.8	6.2	3.7	9.5	2.1
Zinc concentrate	.34	6.5	2.2	50.5	1.7	8.3	2.4
Tailings	.02	0.30	0.25	0.50	0.10	-	-

Shenandoah-Dives Mill

The millsite of the Shenandoah-Dives Mining Co. is favorably situated in the Animas River Valley about 2-1/2 miles northeast of Silverton. Oil-surfaced Colorado State Highway 110 passes the mill, permitting delivery of supplies and transfer of concentrates to the railhead by truck at any time during the year.

The plant was constructed during 1929 and was enlarged gradually to a capacity of 750 tons per day by 1937. Custom ore was accepted first in 1935. A bulk lead-copper-iron concentrate was produced prior to the acceptance of custom ore. The custom ore contained a higher percentage of lead and zinc minerals than the company ores, making separation economically necessary. The practice of making a bulk concentrate is still followed; however, this product is now reground and treated by selective flotation.

Milling

The company's own ore is delivered to the mill over a 10,000-foot aerial tram from the mine in Arrastre Gulch. The ore is crushed to minus 2-1/2 inches before it is delivered to the tramway loading bins for transfer to the mill. The mill (fig. 22) is provided with a storage bin of 800 tons capacity. The ore is then passed through a Symons 4-foot short-head cone crusher and is delivered to a 6- by 8-foot Marcy grate mill at minus 1/2-inch mesh. The Marcy mill discharges through a 6-mesh trunnion-trommel screen to a Dorr classifier in closed circuit. The classifier sands are split, a variable amount being fed to a 6- by 5-foot Stearns-Rogers overflow ball mill, and the balance as desired is returned to the Marcy mill. The

Generated on 2024-09-19 21:58 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

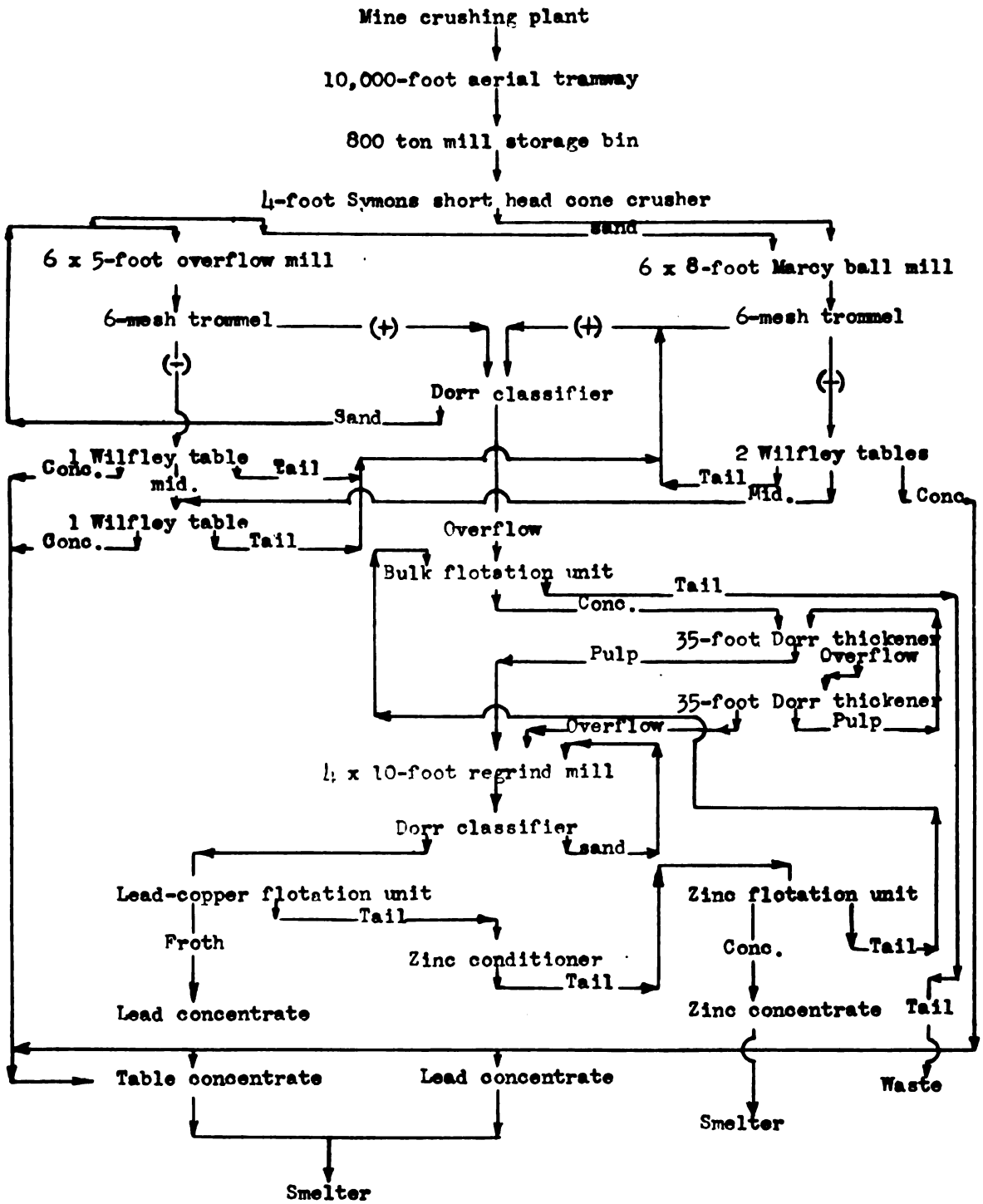

Figure 22. - Shenandoah-Dives mill, Silverton, Colo.

Generated on 2024-09-19 22:03 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Stearns-Rogers mill also discharges through a 6-mesh trunnion-trommel screen, and the plus 6-mesh material is returned to the Dorr classifier that operates in conjunction with the Marcy mill. The overflow from the classifier, which serves both ball mills, approximates 15 percent plus 48-mesh and 45 percent minus 200-mesh and furnishes the feed for bulk flotation units.

The minus 6-mesh material from the trunnion trommel screens of both the Marcy and the Stearns-Rogers ball mills is passed over tables, and the tailings are returned to the Dorr classifier. The table section comprises three Wilfley tables, which produce about 3 tons of high-grade concentrates per day.

The bulk flotation circuit comprises six 66-inch cells used as roughers, followed by four 56-inch cells functioning as scavengers. The tails from the scavenger cells are wasted, and the froth concentrate is broken up and settled in two Dorr, 35-foot thickeners operating in series. The underflow, the thickened material, is reground in a 4- by 10-foot Stearns-Rogers tube mill operating in closed circuit with a 6-foot Esperanza-type classifier. The Esperanza-type classifier overflow furnishes the feed for the lead flotation circuit at a pH of 9.0. This circuit comprises 12 flotation cells, and the product, a copper-lead concentrate, is filtered. About 8 to 10 tons of concentrate are produced per day.

The tailings from the lead circuit are conditioned for 30 minutes and raised to a temperature of 70° F. and a pH of 10. The zinc is activated by a solution of ammoniacal copper sulfate fed to the conditioner. The concentration is made by six flotation cells. The froth from these cells is pumped to the zinc filter, and the tails are returned to the bulk circuit.

No water is reclaimed from the tailings, as sufficient supply of water is available from streams and springs in the vicinity. The tailings are impounded until settled, and the Animas River is not allowed to become contaminated.

A table showing the reagents, amount used, and the point of addition follows:

Name	Amount	Where added
Am Cy No. 404	0.07 lb. per ton	Grind
Yarmour F	Mix) .01 to 0.02 lb. of 50-50 mix	Do.
Iso-Butal Carb		
Aerofloat 208	.01 to 0.02 lb. per ton	Do.
No. 301 and Z-8	Mix) .08 lb. per ton 50-50	Bulk rougher
Zinc sulfate	.7 lb. per ton	
Sodium sulfate	.5	
Aerofloat 208	.01 to 0.02	
Sodium cyanide	.01 to 0.02	
Lime	.25	
Aerofloat 242	.01	
Copper ammo sulfate ...	.2	Conditioner
Sodium aerofloat B	.01	Zinc circuit
Lime	To pH 8.9 to 9.0	
Heat	To 75 to 80 degrees	

Generated on 2024-09-19 22:01 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Analyses of typical mill products are shown in the following table:

	Oz./ton		Percent				
	Gold	Silver	Lead	Zinc	Copper	Iron	Insol.
Heads	0.104	1.66	0.97	0.65	0.28	3.0	-
Table concentrate ...	9.90	41.6	55.6	3.9	.5	11.2	2.4
Bulk concentrate	.91	19.5	12.5	13.6	2.6	16.4	26.9
Lead concentrate	3.51	61.8	51.1	4.3	6.4	10.7	3.4
Zinc concentrate	.08	5.2	.9	60.1	.7	2.5	2.3
Tailings	.015	1.0	.2	.15	.05	-	-

Silver Bell Mill

The Silver Bell mill (fig. 23) is situated at Ophir (Ophir Loop), about 450 feet from the mine portal of the haulage level. It was constructed on the site of an old 40-stamp mill in 1946. Additions underway in 1947, comprising installation of a primary crusher and a washing-sorting plant, are expected to bring the capacity from 140 up to 200 tons a day.

The Salt Lake City Branch of the Metallurgical Division of the Bureau of Mines tested the ore. As a result of the test, milling practices were suggested that are now employed.

Milling

The mine-run ore is dumped on a grizzly constructed of railroad rails spaced about 8 inches apart. The oversize is broken through this grizzly by sledging and drops into the coarse-ore bin. The bin discharges into a 10- by 20-inch jaw crusher, and the crushed ore is elevated to the fine-ore bin by bucket elevator. A belt feeder transports the ore from the fine-ore bin to a 6- by 5-foot Marcy-type ball mill in closed circuit with a spiral classifier.

The classifier overflow is conditioned and passes through a unit flotation cell. The tailing from the unit cell enters the second cell of an 8-cell flotation machine. The concentrate from the unit cell and the concentrate from cells 2, 3, 4, and 5 are cleaned in cell 1 and then filtered. The concentrate from cells 6, 7, and 8 re-enters the circuit with the feed to cell 2. The tailing from the flotation section is automatically sampled and treated on a Wilfley table, which is used primarily as a pilot table, but a small amount of wolframite concentrate is produced. The table tailing flows through a 2,000-foot flume to the tailing settling pond. The surplus overflow from the filter is settled in a thickener, and the pulp is returned to the filter by a diaphragm pump.

The reagents added to the ball mill feed are soda ash or lime, and at the conditioner, pine oil, xanthate, cyanide, cresylic acid, and methyl iso butyl carbenol.

At the time the information on the operation was obtained, neither the mine nor mill had reached capacity production, and the heads and mill products were not typical of what is to be expected.

Generated on 2024-09-19 21:56 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

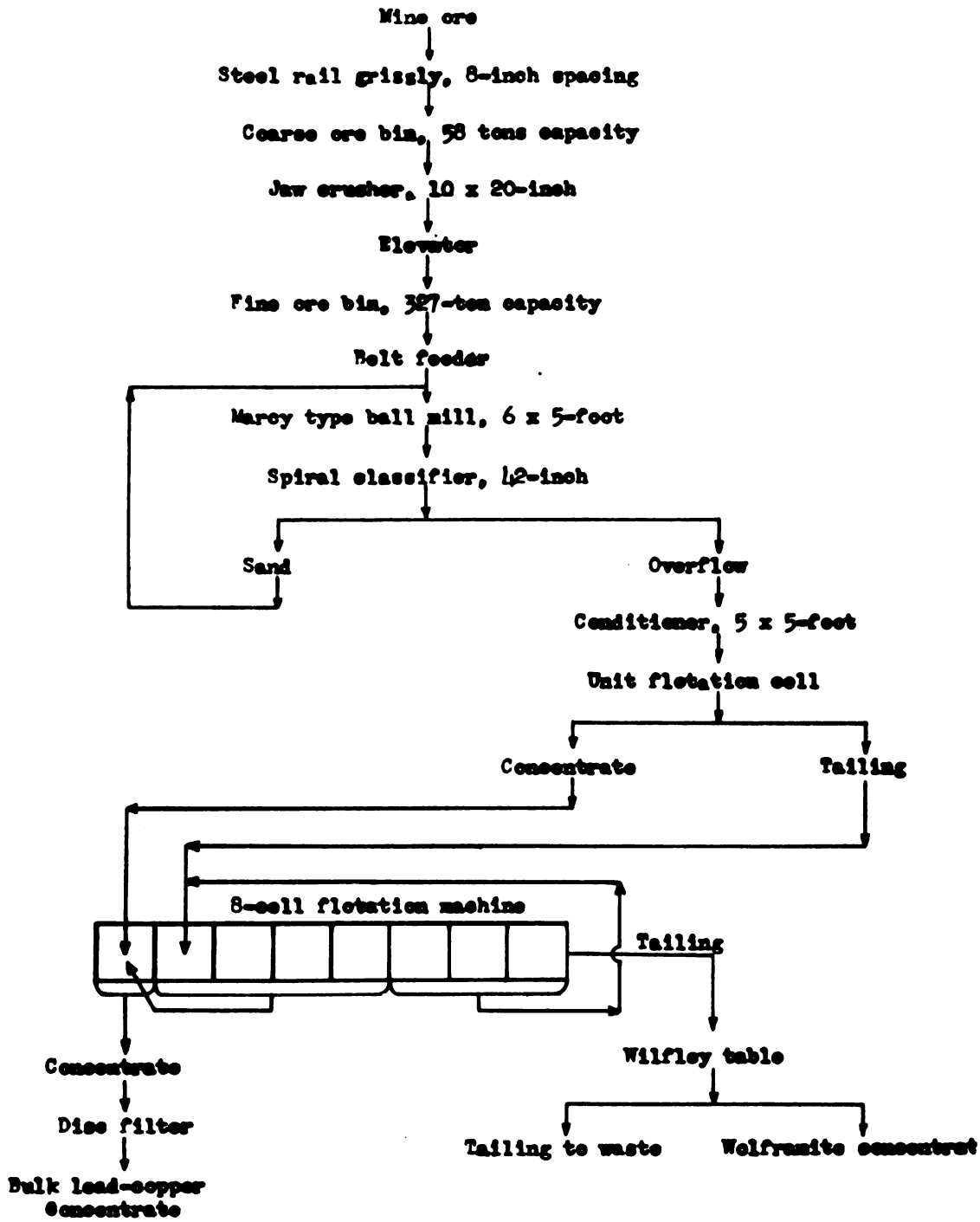

Figure 23. - Flow sheet of the Silver Bell mill.

Generated on 2024-09-19 22:00 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Idle Mills

Alta Mines, Inc. Mill

The Alta Mines, Inc., mill was idle when visited in December 1947. It is about 4 miles from Ophir, Colo., in San Miguel County, and 14 miles from Telluride. The plant was constructed in 1936, and apparently little change has been made since. Operation has been sporadic in recent years. It uses flotation for the production of lead, zinc, gold, and silver concentrates.

Paragon Mill of San Bernardo Mine

The Paragon mill is situated at Matterhorn, on Highway 145, about 15 miles from Telluride. It was built in 1921, remodeled in 1926, and has been idle since 1928. The mill has a nominal capacity of 175 tons a day and used flotation to recover lead, zinc, gold, and silver.

Ore is delivered by aerial tram 1,850 feet across the gulley from the San Bernardo mine. The ore was crushed at the mill through a No. 3 Gale gyratory crusher and was retained in a 250-ton wooden mill storage bin. A feeder charges a 6- by 5-foot ball mill, overflow-type, and an old Dorr drag classifier sends its sands to a jig and the overflow to the bulk flotation circuit conditioner. The jig made a hutch and a tail. The hutch product was sent to a smelter, and tails were treated in a unit flotation cell. The unit cell tails were returned to the ball mill, and the froth concentrate was filtered and sent to the smelter.

The classifier overflow was conditioned in a wooden tank whose discharge was led to No. 1 cell of a 6-cell, 18 by 24, flotation unit. Tails advanced through the unit, and all froths were collected and sent to the filter. The tails of the first flotation unit were re-treated in another 6-cell flotation unit. Froth advanced to No. 1 unit, and tails were fed to a Wilfley table for visual assay. This table apparently made no products.

Generated on 2024-09-19 22:04 GMT / https://hdl.handle.net/2027/osu.32435030643738
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY